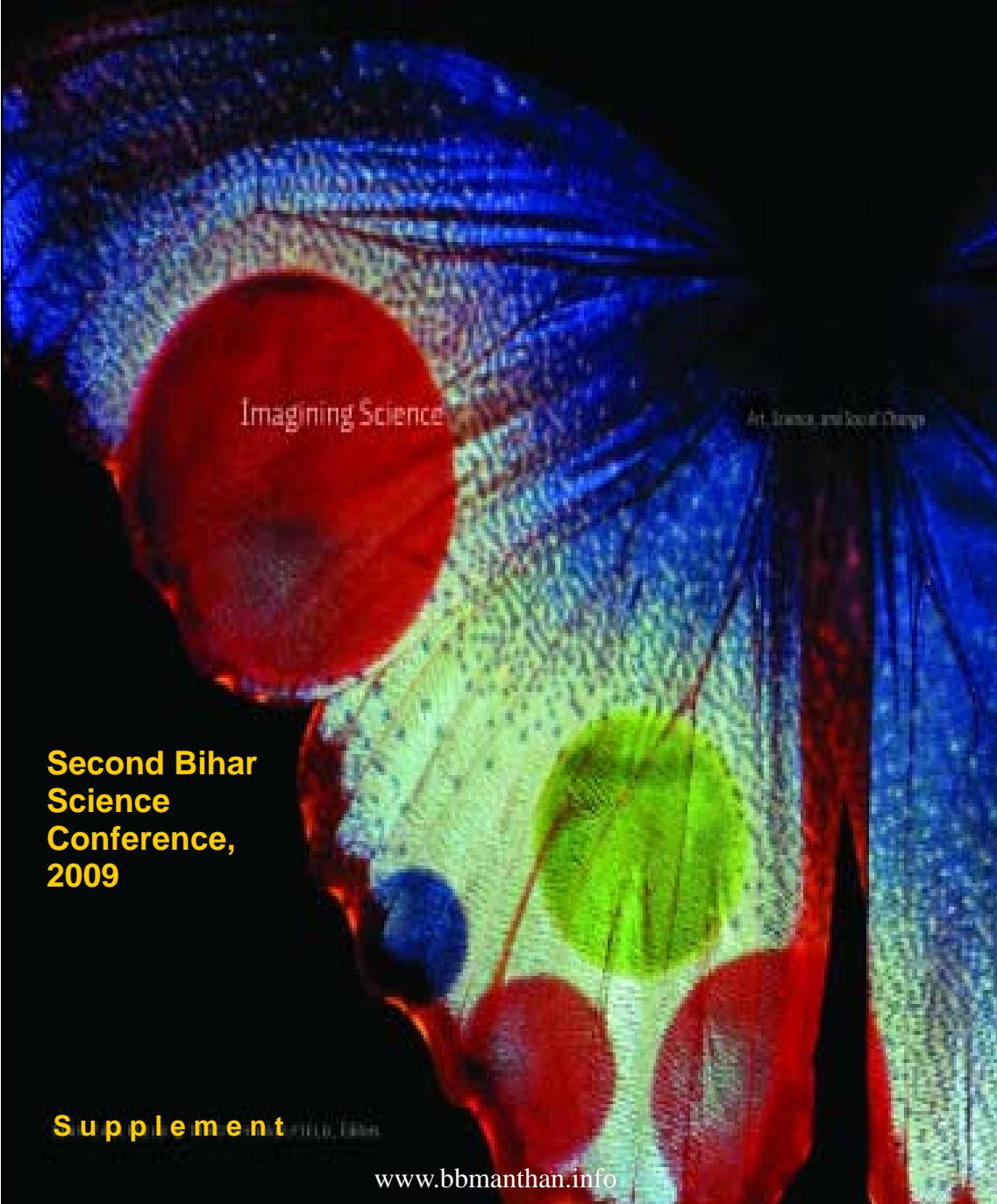




Manthan

A Quarterly Magazine Published by BiharBrains

April, 2009



Imagining Science

Art, Science, and Social Change

**Second Bihar
Science
Conference,
2009**

S u p p l e m e n t

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Manthan is a quarterly magazine published by BiharBrains, an international Forum of educated people of Bihar with the objectives of sharing ideas, knowledge and achievements which can be benefited to the scientific and non-scientific community.

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From Editors desk

Recently, Global Scientific Council of BBrains Development Society organized an international conference "Second Bihar Science Conference 2009 (BSC2009)" in association with Magadh University at its PG Center of College of commerce, Patna (India) from Jan 30 to Feb 1, 2009. The theme of the conference was "Science and Society in the perspectives of Bihar and its needs". On this occasion, around 500 delegates of India and abroad were participated and eminent scientists of from various universities namely NASA Langley Research Center, Ryerson University (Canada), JNU (Delhi), DRDO, IITs, NITs, Central universities and state run universities and colleges of India took part in the serious scientific discussion.

This conference has become platform for the scientific development of the state as well as the nation. And now global members use this society as forum to help and support research activities of the colleges and universities of Bihar. Recently Konkuk University of South Korea made tie-up with college of commerce, Patna (Magadh University) in the field of Biotechnology, their students visited South Korea under ABTF program of Konkuk University; many more tie-ups are in pipeline. The Society just helps and coordinates between both parties till the MOU has been signed. This way conference is getting popularity among academics and researchers of the state. During BSC 2009, Global Scientific council also discussed to establish university of science and technology in the state of Bihar under BBrains Development Society which will be focused on research and development and will be unique in teaching and R&D methodology. These all are possible because of the effort of the global members from different parts of India and abroad who wish to contribute for their mother land. I salute all those who contribute for the noble cause.

This SPECIAL Issue of Manthan is the supplement of BSC 2009 which covers selected full length papers/articles of delegates, keynote speakers and young scientist awardees of the said conference.

We solicit your reactions, comments and suggestions in the mailbox and expect that with your help and support in future this magazine will grow into a versatile platform.

For details you are free to visit our website www.bbmanthan.info

Bibhuti Bikramaditya
Chief Editor

Second Bihar Science Conference, 2009: A Report

A three day international conference "Bihar Science Conference 2009" held at PG Center, College of Commerce (Magadh University), Patna from January 30 to Feb 1 2009, under the aegis of B.Brains Development Society concluded successfully on a positive note. About 500 people from across the country and abroad participated in the Conference. B.Brains Development society, popularly known as BiharBrains is a non profit organization registered under society act with special focus on awareness building on education and creating environment fro research and development in Bihar. The society came in existence in 2004. it is being run by NRIs, NRBs and educated people of Bihar.

The objective of the conference was to bring together the experts from various fields to discuss and evolve suitable measures for high resolution outcome and to exploit the collective efforts to create the favorable working environment for research and development in the state. Theme of the conference was "Science and Society in perspective of Bihar".



(Sri Harinarayan Singh Hon'ble Minister for Human Resource Development inaugurating Second BSC 2009)

The conference was inaugurated by Shri Harinarayan Singh, the Hon'ble minister, Dept. of Human Resource Development, Govt. of Bihar on Jan 30, 2009 at 12 noon.

The Chairman of the conference Prof. Jainendra Kumar introduced the theme of the conference and welcomed the esteemed guests and participants. While introducing objectives, he hoped that this conference would prove to be a fortuitous opportunity for the young and budding scientists of the state of Bihar working in different areas of Science ranging from Physical/Chemical Sciences to Modern Biology. Unlike the last conference, 2nd Bihar Conference would also have experts and researchers from the areas of Mathematics and Clinical Psychology, he said.



(Sri Harinarayan Singh addressing gathering)



(Prof. Jainendra Kumar, Chairman of BSC 2009 introducing theme of the conference)

The message of the global chairman B.Brains Development Society, Mr. Bibhuti Bikramaditya was read by the convener of the conference Dr. Santosh Kumar.



(Dr. Santosh Kumar, convener of BSC 2009 reading message of the Chairman)



In his message, he said that BiharBrains is committed to help/support Bihar based colleges and institutes through international collaborations, international projects and scientific interaction to improve R&D environment in the state as well as we will establish R&D institutions, Universities in Bihar by means of contribution/donation of global Bihar Members whose heart beats for the development of the state, who want to see Bihar, a developed state of Indian Union. He also announced that BiharBrains is seriously considering on setting up of University of Science and Technology at Patna.

Hon'ble Principal of College of Commerce, Patna Prof. Subhash Prasad Sinha Presided the inaugural function.



(Prof. S.P. Sinha, Hon'ble Principal of College of Commerce, Patna)

A book “**How to get a Job**” written by Jyoti Prakash Lal and the College magazine “**Vimarsh**” of College of Commerce Patna was released by the Hon'ble Minister, Dept. of Human Resource Development , Govt. of Bihar. Who was the Chief Guest of the function.



(Invited Chief Guests releasing abstract book and Souvenir of BSC2009)

Shri Harinarayan Singh, Hon'le Minister. Dept. of Human Resource Development Govt. of Bihar stressed in his inaugural address that his govt. is very

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much concerned to ignite the scientific temperament of the state and develop organized research in Bihar. He expressed happiness to see the honest effect of B.Brains Development Society for exploiting genius, knowledge and expertise of Bihari Scientists working abroad for development of Bihar. He assured every help and support from the part of his government for any academic endeavor of this type that may help the state to hoist it flag in proving excellence in scientific and technological research on national and international scale.

Hon'ble Minister thanked organizers to organise such scientific events in state and hoped that this science conference will go a long way in creation scientific temperament among the youth, vital for nations Development.



(Eminent Scientists and delegates during Inaugural function)

Prof. R.P.Sinha, chairman of the Global Scientific Council of BiharBrains thanked Magadh University for hosting the conference at college of commerce, Patna. He also outlined the mission of this council which has been formed for the purpose of organizing science conferences, scientific festivals, establishing R&D centers and building work environment in the state.



(Prof. Rajmani Prasad Sinha, ex-VC, L.N.Mithila University, addressing gathering as a chairman of Global Scientific Council of BiharBrains)



Prof. U.N.Singh, Chief technologist NASA delivered is inaugural Keynote presentations on NASA's future: Earth Science mission for global observation and societal benefit: Vision and challenges vote of thanks was given by Dr. Binod Kumar Mangalam.



(Dr. U.N. Singh, Chief Technologist of NASA Langley Research Center, USA delivering his keynote in the Inaugural function)

In post lunch technical session, Dr. Rajesh Kumar Mishra, Asst. to President, A-1, Technologies. Inc, USA, delivered his keynote presentation on "Use of platinum group metals in automobile catalytic converters for pollution control and Dr. B.K.Karna, Deputy Director (regional head) , Indian Institute on Packaging, Hyderabad delivered his keynote presentation on packaging technology for progress in Bihar; when and how.



(Dr. Rajesh Mishra, A-1 Technologies.inc, USA)

A beautiful and impressive cultural programme was organized by College team which was greatly enjoyed and widely appreciated by the participants.

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Day II: Jan 31, 2009

On day II Six, keynote presentations were delivered by different scientists of India and abroad in different technical session.

Prof. A.K.Roy, Professor of Botany TMBU, Bhagalpur delivered his keynote presentation on "Global scenario of Herbal drugs and their quality maintenance".

Prof. P.K.Yadav, Dean and Head, Deptt. Of Life Science, JNU, also highlighted some his original research and could motivate the participants to be able to pursue research ever in scarcity of resources and infrastructure.

Dr. K.D. Kumar, Associate Professor & Canada research chair in space system Dept. of aerospace, engineering Ryerson University, 350, Victoria street. Toronto, Ontario, Canada, delivered his keynote, address on "Physical Science" research and development needs fo Bihar in 21st Century: A personal perspective.



(Prof. H.C. Verma, IIT Kanpur delivering keynote presentation in Physical Science)

Noted scientist, Prof. H.C.Verma, Dept. of Physics, IIT Kanpur delivered his keynote address wonderfully on “Science and Technology in ancient India, inspiration for future.



Apart from these keynote addresses some standard research papers were also presented in parallel sessions in Chemical Biological, Earth Science and Electronics.

Dr. Santosh Kumar, Dr. B.C.Roy, Dr. Amarendra Narayan & Dr. Rakesh Kumar singh. Game a show on low cost experimentation with and aim to popularize basic science and develop science studentship.



(Delegates presenting paper)



Dr. V.N. Sharma, Chairman Jharkhand Vigyan Manch, Ranchi delivered his keynote address on water resource management and Dr. Himanshu Shekhar, Deputy Director, HEMRL (DRDO) Pune delivered him keynote on “Design of gas generator propellant grains for missile application”.



(Dr. V.N. Sharma, water resource management consultant with Dr. Amarendra Narayan, Dept. of Physics, Patna University)



Day III : Feb 1, 2009

Some research papers in physical Sciences, Mathematical science, and Clinical Psychology were presented in parallel session, apart from four illuminating keynote address.



(Dr. B.K. Sharma, HOD, Electronics, NIT, Patna (left) and Prof. H.C.Verma of IIT Kanpur in Technical session)

Prof. B.K.Sharma, NIT, Patna delivered his keynote address on electronic science. Prof. Vijay A. Singh, TIFR, Mumbai talked on “The science Olympiad National and international in his keynote address.



(Prof. A. Yadav, ex-VC, BRA Bihar University along with delegates in question Answer session of technical session)

Prof. Balganadhar Prasad, dept. of Mathematical, B.N.college, Patna delivered his fascinating lecture on “Contemporary challenge before mathematics in his keynote address.

Prof. Raman Kumar Jha, SMIT, Sikkim delivered his keynote address on Particle Physics and future direction of research.



Poster presentations were evaluated by a team of experts and two of them were given best poster presentation award.

- (1) Pawan Kumar, Aircraft Maintenance Engg. Bharat Instt. Of Aeronautics, Patna
- (2) Kumar Rishav of RPSIT, Patna

Three oral presentations – Following three best presenters were selected for Young Scientist Award.

- (1) Dr. Sidheshwar Prasad by Deptt. Of Biotechnology, college of commerce
- (2) Akanksha Anand , Abhimanyu Kr. Sumya Priyadarshini by Deptt. Of Electronics & IT, RPSIT, Patna
- (3) M.Danish by Deptt. Of chemistry, Aligarh Muslim University, Aligarh.



(Prof. H.C Verma of IIT Kanpur presenting young scientist award)



(Dr. U.N. Singh and Mrs. Singh presenting young scientists award)



(Young Scientists awardees with Dr. U.N. Singh, Chief Technologist, Langley Research Center, NASA, USA)

A panel discussion was held in pre valedictory session in which different suggestion from participants were taken note of.



(Prof. Jainendra Kumar in Valedictory function)

Valedictory function was president by Prof. P.K.Yadav JNU, and Prof. U.N.Singh, Chief Guest of the function. Prof. Vijay A.Singh, TIFR Mumbai and Prof. H.C.Verma, IIT Kanpur were the guests of honour.



(Dr. U.N. Singh(Chief Technologist, Langley Research Center, NASA), Prof. H.C. Verma(Dept. of Physics, IIT Kanpur) and Prof. Vijay A.

Singh(National coordinator, National Science Olympiads, Tata Institute of Fundamental Research, TIFR, Mumbai in Valedictory function)

After the valedictory function a meeting of the scientific council was held at 7 pm which was attended by Dr. U.N.Singh, Prof. H.C.Verma, Prof. Raman Kumar Jha, Prof Rajmani Prasad Sinha, Prof. Jainendra Kumar, Prof. Dolly sinha, Prof. B.K.Sharma, Dr. L.K.Jha and Dr. Santosh Kumar. This was a session meeting in which possibility of establishing a technical University under the umbrella of B.Brains Development Society was discussed apart for some other important issues.

Other important Pics:



BB staff members and delegates enjoying food in BSC2009)

Manufacture of Wireless Power Transmission Sheet using Printed Plastic MEMS Switches and Organic Field Effect Transistors

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Introduction

Everybody suffers from gas at one time or the other due to various reasons like swallowing air while eating meals, eating too fast or bacterial fermentation of food. To suppress tummy gas another gas producing universal agent called “ENO” is used. It is not only this form of gas, but gas is useful for various industrial, biological, physical, chemical, economical or defence applications. The article, a comprehensive holistic view of usefulness of gas is taken. A specific defence application in the form of its use in gas generators for cold launch of large inter-continental ballistic missiles (ICBM) is explained. The article gives world view as well as Indian scenario for the cold launch systems for missiles.

Usefulness of gases

Gases are third form of any substance, which does not possess any shape or size and taken shape of the container. It has pressure, temperature and volume, which can be used to do useful work. Gases have some chemical action and can be used as antacids or riot control agents. Gases in some cases possess definite odour, which is used in scented sticks, perfumes and specific applications. Gases are flammable, which makes it useful in domestic cooking, welding, automobiles, generators etc. Gases in solid makes them porous and subsequently foam type reduced conductivity materials can be conceived.

Liquefied petroleum gas or LPG is synonym of domestic cooking applications. Spray for car wash and painting also uses compressed gases. For personal applications, duo-sprays, perfumes-sprays etc uses compressed gas operated systems. Compressed gases have several other industrial applications. All air-atomization nozzles, humidification system, cooling systems need gases in one form all the other.

Wheels of automobiles use compressed air for better grip and reduced friction. At the same time CNG or Compressed natural gas is used for powering automobiles. During first half of twentieth century, hot air balloons were used for air-transportation. The series ended with the tragic Hindenburg disaster of 6th May 1937, when 35 out of 97 persons on-board died.

Recently germany has developed a car, named CLEVER (Compact Low Emission Vehicle for Urban Transport), which operates on natural gas. It weighs less than 400 kg and can run at a speed of 100 kph.

As far as defence applications are concerned, gases are used for almost all the systems. Smoke grenades are used for obscuration, marking, signaling and tracking purposes. Coloured smoke is also used for various signature creation and displays. All gun projectiles, shells and rounds are propelled out of gun-chamber by rapid generation of hot combustion gases behind the projectiles. To enhance range of projectiles, base-bleed concepts are also professed. Rocket propulsion is direct application of gas generation. Combustion of solid propellants in rocket motor chamber generates high volume of hot combustion gases, which is thrown out of the chamber by a small vent resulting in forward motion of rockets.

In fact, the first system in defence field moved by gas generator made their appearance during Second World War, in German combat aircraft with ejection seat in 1944. Propellant cartridge has also been successfully used in the starting of piston-engine aircraft.

Gas generators for Cold Launch of Missiles

Solid propellants are extensively used for propulsion of rockets, missiles and space launch vehicles. In addition, they are also used for attitude correction, small thruster, nose-cone separation, retro and gas generation applications. Solid propellants are shaped in pre-defined ballistic configurations, called grains. Upon suitable ignition, they produce high volume of combustion products at high temperature. Suitable confinement produces high pressure and reaction of expansion though rearward positioned vent propels missiles and launch vehicles in forward direction. Simple configuration, easy design and quick deployment offset minor disadvantages of low energy of solid propellants with respect to liquid propellant and their versatility is proven in many existing missiles and other systems.

The generation of high volume of high temperature exhaust gases from combustion of solid propellant is exploited in gas generator applications.

In civilian application, they are used in crash-bags of cars, where inflation of bags is accomplished with the help of burning solid gas generator charges. In defence and launch vehicles, it has several applications. They are used for gas displacements, control surface unfolding, pressure actuation devices, electrolyte displacement for battery operation and also for cold launch of missiles. For general applications, gas generators are supposed to quickly release a large volume of gases and configuration or shape of gas generating solid pellets is not very important.

However, for cold launch of missiles, gas generators have to burn in a progressive fashion and their requirements are quite different and stringent. All vertically launched systems can have either **hot launch**, when missile is fired to move or **cold launch**, when missile is given initial motion with additional auxiliary system. In hot launch of missiles, additional weight, size, maintenance requirement, and initial production cost for the additional power sources is less. The missiles of the hot-launch system also come out of their tubes and are immediately ready to start seeking their targets.

However, this is offset by one major advantage of the cold-launch system i.e. safety. Should the missile engine malfunction while the warhead is armed to detonate during firing, the hot-launch system could be doomed, but the cold-launch system can still eject the missile out of the cell and eliminate or reduce the threat. Another advantage of the cold-launch system is in its low life-cycle cost of the launching tubes: since the engine starts within the tube in a hot-launch system during launches, the tubes of the hot-launch system can only sustain a limited number of launches - after which the tube must be replaced (just like in the large naval guns of obsolete & retired ships). A cold-launch system, in contrast, can last much longer because the tubes are not subject to the extreme heat blasts as are those of the hot-launch system.

The "cold launch" system, first implemented in the R-36M missile, was designed to eject the rocket from the silo with the help of a special Powder Pressure Generator, or PAD (Pressure Actuated Devices). The main propulsion system of the missile would then ignite in midair. Installed in the silo, the PAD generator was capable of sending a 210-ton vehicle up to 20 meters into the air, where the missile's engine would come alive. The "cold launch" technique allowed the deployment of missiles in smaller and cheaper silos without complex exhaust deflection systems required for the R-36 missiles, which fired its engines inside the silo (Gubarev, V., Yuzhny Start, Russian, Nekos 1998). In fact China is also developing cold launch gas generating systems for missiles.

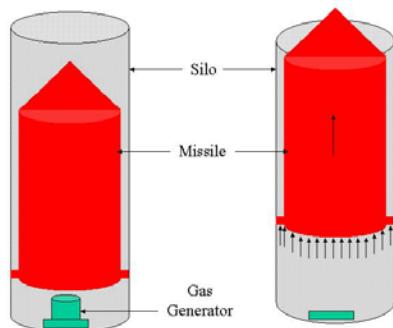


Figure 1. Cold Vertical Launch Missile

Gas generator for cold-launch systems, work on simple piston-cylinder arrangement. Such missiles are stored in silos in vertical position. On combustion of gas generating cartridge, high volume of gases is generated, which lifts whole missile (Figure 1). Later on combustion gases has to compensate for both movement of missile and extra volume created due to movement of missile in the silo. This demands a very high progressivity of combustion. Sometimes mass flow rate has to be made even 5-6 times initial mass flow rate to accomplish this task. Normal solid propellant grains are designed for better neutrality and lesser tail-off, but for gas generating application a highly progressive variation of burning area is needed from propellant and tail-off is not paid much attention. The task is assumed to be complete, when missile goes out of silo and ignited in mid-air.

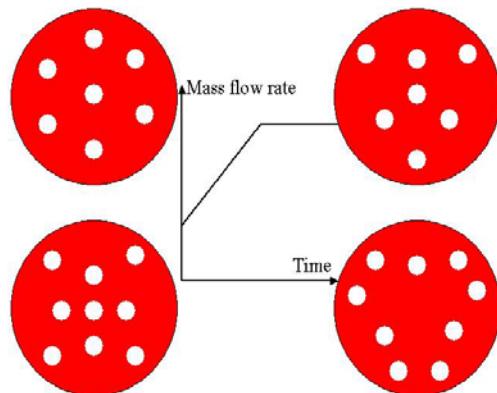


Figure 2. Different Multi-perforated configurations for Gas generators

In general, normal propellant configuration like tubular, star, slotted tube or fin-o-cyl will not be able to meet these requirements of high progressivity. So multi-perforated cylindrical propellant grains (Figure 2) are conceived for such applications. The geometry can be tailored for different progressivity ratio, dimensions and propellant configuration to meet the system specifications and requirements.

Examples of Cold Launch of Missiles

Large missiles are stored vertically in hard silos. Their propulsion may start from silo, but hot combustion gases may make silo-reuse impossible. To compensate this, additional system is needed to bring missiles to above silo and then fire.

The Atlas F, the most advanced US missile of the Atlas series, was designed to be stored vertically in "hard" or "silo" sites. With the exception of its massive 45-ton doors, the silos, 174-feet deep and 52-feet in diameter, were completely underground. During the firing sequence, the missile was fueled, lifted by an elevator to the mouth of the silo, and then fired. This is a complex system and needs more power, more moving parts and thereby reduced reliability.

However, Russians developed the idea of gas generator based cold launch systems for missile. Vertically stored missiles are designed to be launched from silo with the help of small solid propellant based gas generators. There are several Russian missiles, which are reported to be using such concepts. RT-21M / SS-20 SABER is a 1.79m diameter, 16.49 m long and 37 ton launch weight Russian missile, where before ignition of the first sustainer stage the missile is popped out of the container with the help of a solid propellant gas generator the missile and then first stage sustainer is started. The SS-20 silo also has the capability to be reloaded and refired. Another missile SS-18 ICBM (SATAN) from Russia also employs a cold-launch technique with the missile being ejected from the silo prior to main engine ignition. The special hardened silo was 39 meters deep and had a diameter of 5.9 meters. Yet another one, SS-25 is a cold-launched, three-stage, solid propellant, road-mobile ballistic missile and has the Russian designation RS-12 M, is called 'Topol' (poplar tree), and is believed to have the identification number 15 Zh 58 or RT-2PM. The missile is stored and fired from a launch canister that is 22 m long and 2 m in diameter. The missile is cold-launched from the canister, using a solid propellant gas generator.

Russian technology is perfected by China also and they also developed missiles with similar vertical launch concepts. DF-31 missile of China has three solid-propellant stages that are believed to have a 16.0 m length, a 2.0 m body diameter, a 42,000 kg launch weight, and 8,000 km maximum range. The missiles are stored, transported and launched from a

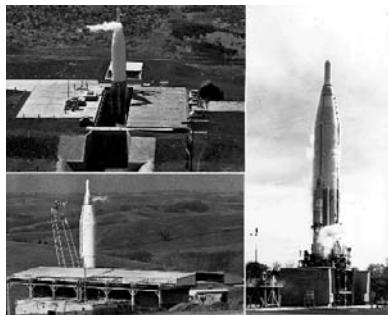
canister, with a solid propellant gas generator in the base of the canister providing a cold launch. The first stage solid propellant motor is ignited after the missile clears the canister, so that the canister can easily be re-used.

Later on America also adopted this technology for its missiles. The Peacekeeper (designated LGM-118A) is a four-stage intercontinental ballistic missile. The "L" indicates that the missile is silo-launched; the "G" indicates that it is designed to attack ground targets; the "M" indicates that it is a guided missile. The entire missile is encased in a canister in the silo to protect it against damage and to permit "cold launch". Peacekeeper, which was decommissioned in 2003, is ejected by pressurized gas some fifty feet into the air before first stage ignition.

India also has developed cold launch techniques for missiles. Solid propellant hot gas generator is used to launch a missile from canister. DRDO has designed and developed a solid propellant hot gas generator which produces highly progressive mass flow rate. To achieve this, high burn rate non-metalised inhibited composite propellant based on HTPB has been developed. Motor is designed to operate on a pressure range of 15 to 200 kg/cm² with factor of safety of 2 to increase the reliability¹.

Conclusion

Gases have multi-dimensional multi-faceted, multi-operational uses. Gas generators exploit one or more of salient features of gas for industrial, commercial, domestic and defence applications. In defence sector, Gas Generators have several applications like Base-bleed units for artillery shells, Smokes for various applications, Cold gases for actuation and recovery operations, and missile components. Missiles uses gas generators for control surface maneuverability and cold launch of vertically located missiles. Propellant grain design is an iterative procedure and unique answer is always a compromise between competing requirements.



ATLAS – F, USA, Elevator Launched



RT-21M / SS-20 SABER : SS-18 ICBM (SATAN), RUSSIA



SS-25, RS-12 M, "Topol", 15 Zh 58 or RT-2PM, RUSSIA



Dong Feng – 31 Missile, COLD LAUNCH, CHINA



PEACEKEEPER, LGM – 118A,
Cold Launch, USA

Figure 3. Vertical Launch of Missiles by Gas Generators

Sub-prime Debacle: The Greed and Folly of i-Banks Brought the Entire World Economy to the Brink of Catastrophic Collapse.

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Abstract:

September 2008 saw the complete collapse of the Major Investment Banks in US. The collapse of US financial system led to the freezing of inter-bank loans globally. As a result Investment Banks world over are heavily loan ridden and with too little capital to continue with their day to day transactions. This has led to Global Credit Crunch which in turn has led to mounting bankruptcies of small firms, reduction in production activities, layoffs and sharp fall in share price index. The main trigger of this rapidly spreading economic malaise of credit crunch was the issuance of home loans to people with no income-no job-no assets. These were called NINJA loans. These NINJA loans were converted into Mortgaged backed Securities and these MBS were insured as Credit Swap Obligations(CSO) making them 100% failure proof. These insured MBS were offered as the safest investment bonds for Global Investors who originally invested in US Treasury Bonds. But after 9/11 , 2001, twin-tower catastrophe the return on the these Government Bonds were reduced to 1% and in its place Commercial Banks were allowed to trade in MBS and in CSO. These had a good rate of return of 4-6%. These naturally attracted the world wide investment from LIC and pension funds and their likes. This created a great demand for Securities Bonds and hence a speculative housing bubble was created by recklessly granting NINJA Home Loans and issuing Securities Bonds as an instrument for safe and remunerative investment. By 2006 when equal monthly instalments (EMI) became due the NINJA loanees started defaulting and walking away from their mortgaged houses leaving the i-banks with almost 1 million foreclosures and 1 million forfeited houses. The i-banks could not even recover the loan by the sale of the confiscated houses because there was no taker for the same. This became known as sub-prime housing loan debacle which spread panic in the securities market and then in share markets leading to a colossal credit crunch and the subsequent shrinkage in production activities and massive layoffs which is rapidly snow-balling into a major global economic crisis. Right now US Government, European Governments and all other Governments have no option but to inject equity capital in credit starved banks and underwrite their

bad loans by subsidizing it with Government Bail out packages and this precisely Britain did and all major Central Banks including US followed the cue. This is not the first time that US had to bail out an ailing enterprise. Till now there have been 8 bailouts in the period 1970-2001. In 2008 there have been 5 major bailouts and many more are to follow. If the governments have to keep socializing the losses then there is no reason why the profits should not be socialized. Under the circumstances all large scale production units which can be professionally managed must be nationalized without any delay. Only small scale production units and services which require the special acumen of different category of traders, artisans and business men and which need to be owner managed should continue under private ownership.

INTRODUCTION:

In last one month the five major free-standing i-banks (investment banks) that stood on the top of the mighty financial sector of US came down tumbling like a house of cards and this all happened in the month of September 2008. BEAR STERNS became financially untenable and it had to be bought by J.P.Morgan Bank. On 15th September LEHMAN BROTHERS declared bankruptcy because its shares fell from \$65 per share to 5 cents per share. MERRIL LYNCH could not maintain its credit worthiness and was sold to BANK OF AMERICA for \$50 billion. AMERICAN INSURANCE GROUP, mortgage giant, had to be rescued by nationalization. MORGAN STANLEY & GOLDMAN's SACHS stocks lost all their values and have opted to operate as Commercial Banks(c-banks) and accepted the supervision of Federal Reserve and Security and Exchange Commision.[1] . Even earlier Fannie/Freddie's Morgatge Backed Securities Business was nationalized at a buyout of \$100billion. These five failures led to shock waves through the global finance market. The worries about toxic assets and bad Mortgaged Backed Securities(MBSs) spread from the financial Sector to the credit market and from the credit market it is spreading out to the broader economy. The Dow Jones Share Prices had the steepest fall since 9/11 event. It seemed the wheel of history has made one full turn and we were back

to the days of 1934 Great Depression. Inter-banking lending was completely frozen and today it continues to be frozen. Foreign Institutional Investments have been busy offloading their shares and taking out their investments from India. They have taken out \$10 billion equity capital from the Indian Market. But this has badly shaken the investors confidence in share market leading to serious credit crunch and fall in Indian Share Prices. In fact Share prices all over the Globe had a drastic fall. All this has led to a colossal credit crunch leading to shutting down of businesses, unemployment and recession rapidly becoming depression. In last two years, 1 million became homeless with foreclosures mounting relentlessly. In USA from Jan to August 2008 there were 610,000 jobless and in September alone 159,000 jobs were lost.[2]

GENESIS OF THE FINANCIAL CRISIS:

A. 1933 Glass-Steagall Act and its undoing:

After the First World War, there was rapid economic development in USA because the countries most effected by the just concluded war were European Countries. But soon the bubble of development popped out and the Great Depression of 1934 set in USA and the continents. Howard Hoover, the then President of USA, lost massively in Presidential Election and President Roosevelt became the President in those difficult times. He introduced "REGULATION MEASURES" to check the unfettered capitalism which tends to be speculative, parasitic rather than productive. This regulation is known as 1933 Glass-Steagall Act. This separated commercial and investment banks. It also set up the system of Federal Regulation of the work of the financial sector. Under this Act, House of Morgan was split into Morgan Stanley i-bank and J.P.Morgan c-bank.

In 1944, 730 delegates from all 44 allied World War Nations met at Mount Washington Hotel in Bretton Woods in New Hampshire. The occasion was UN hosted Monetary and Financial Conference. At this conference Bretton-Wood System of Global Management was created. This was the system of rules, institutions and procedures that regulated the international monetary system. Under this international monetary system, International Bank of Reconstruction & Development (IBRD) and International Monetary Fund(IMF) were created. It irrevocably broke down in 1971 when US suspended convertibility of Dollars into Gold. In effect DOLLAR became the reserved currency for all Nations.[3]

In 1970 when Richard Nixon Administration tried to undo 1933 Glass-Steagall Act, US Supreme Court had warned against this move. In 1990 Federal Reserve Chairman Allan Greenspan allowed J.P.Morgan(c-bank) to issue securities or what is

popularly known as Mortgaged Bank Securities(MSBs). In 1996 the investment activities snowballed to 25% for the c-banks. In later part of 1996, Head of Travellers' Insurance proposed merger of Travelers(i-bank) and CitiBank (c-bank) without repealing the Glass-Steagall Act. This merger did not go through. So eventually in November 1999, Texas Republican Senator Phil Gramm pushed through the repeal of 1933 Glass-Steagall Act. Along with the repeal, Commodity Futures Modernisation Act 2000 was passed which created the Shadow Banking System. This was Corporate Welfarism at the worst and dawn of Crony Capitalism. This repeal of 1933 Glass-Steagall Act pitted the securities companies and insurance companies to compete against each other. This was a major factor leading to speculative housing bubble. This repeal allowed c-banks to freely create and trade in MBSs and in Collateralised-Debt Obligations(CDO). Ralph Nader, the consumer advocate, was perpetually blowing the whistle against mismanagement of MBSs.[4,5]

B. 9/11 event and reduction in the rates of US Bonds.

Before 9/11 US Bonds were the safest investment Bonds in Global Investment Market but after 9/11 its rate of return was reduced to 1% thus making these investments very unremunerative. So Global Investors turned to more remunerative securities which were provided by the financial players such as Bear Sterns and Lehman Brothers. As the demand for the securities bonds mounted the need for creating new securities bonds arose. US Banks gave out House Loans indiscriminately to people with NO INCOME NO JOB & ASSETS. This was called NINJA Loans. There was no down payment involved and there was a holiday of 2 years, starting from 2004, in the repayment of the principal amount. The logic behind these unsustainable loans was that in the event of default they could realize the total amount through resale of the mortgaged house. The excessive demand of houses led to real estate inflation which led to inflation in general. In 2006 when the moratorium on the loan repayment was over Equal Monthly Instalment (EMI) on house loans sharply rose. This caused a series of default and forced foreclosures. The seized houses were in excess of demand therefore their prices fell. This led to the popping of the speculative house bubble.

C. The consequences of the bursting of Speculative House Bubble.

Just as we have Stock Market we have Mortgaged Backed Security(MBS) Market in USA. The MBS are issued by 8400 federally insured Institutions holding \$13 billion worth of Net Value Assets(NVA). NVA keeps rising as long as mortgages are appreciating and inter-bank loan interest rates are low. As we have pointed out above that the US Security Bonds were at premium in the

world market so i-banks sensing a big potential global securities market , in 2004 they very consciously and methodically created the speculative housing bubble. NINJA took new loans from investment banks to refinance the house loans at low interest rate. The i-banks issued security bonds to general public to finance these NINJA loans at low interest rate. These are MBS. This led to heavy demand of houses leading to inflation in house prices. House Inflation led to general inflation. In 2006 interest rates on inter bank loans started increasing due to general inflation and principal repayment holiday was over. So suddenly instalments of loan repayment sharply shot up. NINJA loanees defaulted leading to confiscation of mortgaged houses. Almost 1 million houses were confiscated and put up for sale. There was a glut of houses in the market and house prices rapidly depreciated. This rapid depreciation made house MBS worthless. Because of this \$850 billion worth of MSP out of \$13 trillion could not be honoured. This led to Bear Sterns being bought by J.P.Morgan, Merril Lynch being bought by Bank of America , Lehman Brothers being declared Bankrupt and American Insurance Group being nationalized just as Northern Rocks in Britain was nationalized in UK in early 2007. Fannie/Freddie was nationalized at a cost of \$100 billion.

Because of lack of confidence in securities , not only house MBS, but all kind of securities have lost credibility. Toxic assets first effected the securities market. This effected the share market. This in general effected the whole of Global Economy. i-

Banks built fancy derivative packages and in effect facilitated billions in trading these securities and investing in these low quality loans. Hedge Funds, pension funds and insurance companies funds got lost in the securities market. This caused serious shrinkage in productive activities which has led to high unemployment rate which is leading to serious reduction in demand and hence further shrinkage in productive activities.[6] This depressive scenario has hit the stock market so bad that Laxmi Mittal Enterprises has lost 16.6 billion British Pounds in Share Prices and Anil Agarwal's Metal Empire has lost 2.7 billion British Pounds in Share Prices.

NEOLIBERALISM LAID THE FOUNDATION OF REPEAL OF 1933 GLASS-STEALGALL ACT [7].

Since the end of Second World War, there has been a continuous debate regarding the free market and unregulated free competition on one hand and planned economy and regulated capitalism on the other. The two view points have been put forward by two idealogues of 20th century. The following table gives the argument and counter-argument for the two sides.

It was the vigorous advocacy of neo-liberalism which resulted in the repeal of 1933 Glass-Stealgall Act and irrevocable break-down of Bretton-Wood System of Financial monitoring.

Table 1. Points and Counter-points in support of Free Economy and Unregulated Capitalism.

'The Road to Serfdom' by Freidrich Hayek (1944)	'The Great Transformation' by Karl Potiny's (1944)
Free Market Economy is Self Regulating.	Free Market Economy is a periodic BOOM-BUST cycle hence destructively unstable with terrible political consequences.
The invisible hand of supply & demand which corrects for imbalances and stabilizes the stock market as well as the commodity market..	The invisible hand is not natural and inevitable especially in the era of Imperialism when Finance Capitalism has emerged with the merger of Bank Capital and Industrial Capital.
Roll back the state and let Economy run by itself. This led to the birth of Thatcherism whereby a Social Welfare State was turned into Free Capitalist State. Privatization and de-investment became the watch word.	Political Decisions shape the market.(This is not first time that a bail out has taken place . See Appendix 1.)
The scenario was repeated in India. Socialistic Political Economy was dumped by Narshima Rao's Finance Minister and Privatization and disinvestment was given the upper hand.	Third World over last three decades has experienced unstable and inequitable neo-liberal economy leading to unacceptable level of social disruption and hardship.
Allan Greenspan eulogized neo-liberalism by stating," The past decade(1980) has mounting global forces quietly displacing government control of economic affairs." He continued " Some Government's bedeviled by emergin inflationary forces will endeavour to reassert their grip on economic affairs." In 2008 during House Debate he made volte-face. "Government should reassert its grip in the form of bail out."	Deregulated Capitalism may create wealth but it cannot distribute effectively. Capitalism is the highest stage of commodity production when even labour power is converted into a commodity. It commodifies social relationship, family, community and even the environment. Ultimately it is self-destructive.
	Marx said 'unbridled capitalism' becomes a kind of mythology, ascribing reality, power and agency to things that have no life in themselves.'

THE EFFECT OF GLOBAL CREDIT CRUNCH IN INDIA.[9, 10]

The Global Credit Crunch has led to the flight of FIIs (Foreign Institutional Investors) They have offloaded their shares worth \$10 billion hence share prices have sharply dropped in Indian Stock Market. Drying up of Foreign Credit Markets has had serious repercussions on Indian Company tapping international market for debt and equity.

There has been all round decline in Capital inflows into Indian Market. Balance of Payments is seriously effected because of downturn in exports. Rupee has depreciated to Rs 49 per dollar. There is declining Asset Prices. Current Account Deficit is widening. All these factors are threatening macro-economic stability.

To overcome the Global Credit Crunch, Indian Govt has twice reduced Credit-Cash Reserve Ratio by 0.5% from 9% to 8% thereby releasing Rs40,000 crores liquidity in the market. RBI has released Rs 200 crores for mutual funds. SEBI has relaxed the guide lines on Participatory Notes to encourage Foreign Institutional Investors.

THE REMEDIES FOR SUBPRIME DEBACLE

“ A sad day for Wall Street, but it may be a glorious day for democracy. Hopefully Congress will now devise a plan that is not based on trickle-down economics. A plan that identifies the real sources of the problem and does something about them-a real

stimulus to the economy, a real programmes to stem the flood of foreclosures and a transparent programme for filling the holes in bank balance sheet. A plan that assures U.S. taxpayers the costs will be borne by those who created the problem. Accountability means paying for the full consequences for one's action- and the financial system has much to account for.”[10]

US Government till yesterday was talking about buying the toxic MBSs. In its place British Government has proposed and implemented buying the equity shares thereby injecting equity capital in a financial sector which has too much bad loan but too little capital to go about the business. British Government is also talking about guaranteeing the bad loans. This guarantee will defreeze the inter banking loans. The European Government has followed suit and US Government has also fallen in line.[11]

Indian Government has reduced Cash Credit Reserve to 6.5% thereby releasing Rs 1,45,000 crores in Banking System. RBI has injected Rs 20,000 crores liquidity in Mutual Funds. Both these steps have had a positive effect on the share market. SENSEX have risen by +174.31 points to Share Price Index at 11,483.40 on Tuesday 14th October 2008. The same day NIFTY rose by +27.95 to 3518.65 Share Price Index.

Table 2. indicates the Government efforts to pump equity capital in Financial Institutions and their magnitude of guarantee of bad loans.

Table. 2. Equity Capital injected into Financial Sector and Bad Loans underwritten by various Governments.[12]

Name of the Govt.	Equity Capital injected	Bad Loans underwritten
France	\$54 billion	\$436 billion
Germany	\$108 billion	\$540 billion
Britain	\$64 billion	
USA	A part of \$700 billion bail out package.	
Central European Banks		Unlimited amount of dollars for defreezing the inter-banking loan.

Some of the other recommendations are the following:

- (1) A massive direct government fiscal stimulus in form of increased government spending in the infrastructure, unemployment benefits, tax rebates to lower income house holds and provision of grants to cash-strapped local bodies.
- (2) An agreement between creditor countries running current-account surpluses and debtor countries running current- account deficits and a recycling of creditors' surpluses to avoid disorderly adjustment of such imbalances. China has \$2 trillion dollar reserves with which US

economy and its currency can be helped and prevented from sinking into chaos.[13]

LESSONS FROM THE SUB_PRIME DEBACLE.

Adam Smith wrote the Bible of Capitalism in nineteenth century. This was ‘Wealth of Nations’ written in late 18th century. In this he extolled the invisible hand of supply and demand and he strongly recommended that in a free market with no government regulations, this invisible hand will take care of the imbalances in commodity market as well as in share market and it will restore a balance in

such a way that supply closely follows the demand. No government planning or intervention is required.

But historical materialism has proved that Capitalism is marked with very unequal development- unequal development of urban and rural, industry and agriculture and between mental and manual. Wherever the rate of return is higher, wherever there is higher profitability that domain of production, that geographical area and the kind of people with specialized and very profitable skills are bound to develop faster than others. In such situations of uneven growth if government does not plan and does not consciously invest then those areas will remain backward for time eternity.

Historical Materialism has also proved that successful countries like USA, Japan, Germany first had a very strong and assertive government which protected their respective economic interests and growth by tariff walls. So it was never a free trade and free economy which was preferred by nascent states. They always preferred protected and regulated trades. They protected their indigenous markets and then only they industrialized. USA had to fight a war of independence against Britain in order to build a protected and regulated market. Meiji's Oligarchs unified Japan and developed a strong central government to protect and regulate their trades as well as their internal market. Junkers of Germany unified the small fiefdoms and their prime minister Bismark ruled by iron and blood in order to industrialize and militarize Germany.

The lessons of Great Depression and the lessons of recurring Boom and Bust cycle hold only one lesson that we cannot afford capitalism. If we will have capitalism, the losses will be socialized and profits will always be privatized. In other words the working class will always be losers. If there is to be equity, justice and continuity of progress we will have to opt for Socialism.

In the present times large scale production and large scale service units should be professional managed with public ownership and small scale production units which require special category of traders, artisans and businessmen supervision should be owner managed and hence under private ownership.

Iraq and Afghanistan War has taken away \$3 trillion from the American Public which other wise would have been used for job, health- care, housing, environment, energy and for immigrants rehabilitation. The \$810 billion bail out package also was unnecessary if the American Corporates had played the games according to rules set by them only. Today 50 million Americans are without health care. But US Govt does not feel it is necessary to cover all with Health Insurance. Today US Government is the Government by the rich , of the rich and for the rich. Vast majority of people lead a marginalized life.

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Appendix I.

Previous Bailouts, Hindustan (Hindi), Monday , 6 October, Patna Edition.

Year	Previous Bailouts.
1970	Penn Central Rail Road nationalized with \$3.2 billion.
1971	Lockheed Bailout with \$1.4 billion special loan. Lockheed is the major AeroSpace Industries.
1974	\$7.7 billion package for FEDERAL RESERVE.
1975	\$9.7 billion help to New York City Administration.
1980	\$3.9billion special loan bailout to Chrysler.
1984	\$9.5 billion bailout to Continental Illinois National Bank & Trust Co.
1989	\$293.8billion bailout to Savings & Loan Institute.
2001	\$18.6 billion bailout to Airlines Industry.
2008	\$30 billion buy-in of Bear Sterns by J.P. Morgan Chase.
2008	\$200 billion for nationalization of Fanni Me/Fddie Mack.
2008	\$85 billion nationalization of American Insurance Groups.



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He worked as Junior Research Fellow at Central Electronics Engineering Research Institute, Pilani, Rajasthan, in the period 67-69. In this period he developed Tolansky Interferometer for measuring thin film thickness of the order of 200Å and Nichrome Resistance of 200 ohm/square sheet resistivity with and temperature coefficient of resistance 200p.p.m per degree. In 69-

72, he completed his higher studies in U.S.A.. After returning to India he worked as Pool Officer in Electrical Engineering Department of Bihar College of Engineering, Patna, Bihar, India, during the period 72-73. This was sponsored by Council of Scientific and Industrial Research. From 73-80, he was engaged in grass root activism in the villages of Bihar. From 80-84, he served as a lecturer in E & ECE Department of I.I.T., Kharagpur. 84-85, he served as Assistant Professor in Electronics & Electrical Engineering Depaertment at Birla Institute of Technology & Science. 85-86, he served as Assistant Professor and Head of the Department in Electronics Engineering Department of Institute of Engineering & Technology, Lucknow, U.P. From 86 to 97, he was engaged in rural construction activities at his village home in Maniari, Muzaffarpur, Bihar, India. From Dec 97 to date he has been actively pursuing R&D in the field of Microelectronics in Electronics & Communication Engineering Department in National Institute of Technology, Patna. Presently he is in the post of Assistant Professor and Head of the Department. He has been actively engaged with the study of Planetary Satellites in his work for D.Sc. under Prof. Bhola Ishwar.

Dr. Sharma in course of his R & D work has written a series of papers on Universal Hybrid - π model which will go a long way in developing and establishing an accurate compact model for analog circuit and system simulation using BJT. In course of his D.Sc. Dr. Sharma has proposed a new theory of Solar System's birth and evolution. With the discovery of exo-planets and their inventory increasing every day both in number as well as in diversity, Celestial Physicists are at complete loss in terms of a coherent theory which can consistently explain the diversity of exoplanets. Dr. Sharma's theory fills the gap. Also other people's work is corroborating the work of Dr. Sharma.

Structural, Magnetic and Photoluminescent Properties of Strontium Ferrite Nanoparticles synthesized using Citrate precursor method

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Abstract

Strontium ferrite nanoparticles were synthesized using chemical based citrate precursor method. In this method, nitrates of divalent metal, trivalent metal iron and citric acid were taken in molar ratio. Citrate precursor was annealed at temperature 450 °C and 650 °C in a muffle furnace that lead to ferrite powder after crushing. The powder samples were characterized using X-ray diffraction (XRD), Vibrating sample magnetometer (VSM) and Photoluminescence spectrometer(PL). The mean particle size observed was 15.7 nm at 450 °C and 20.3 nm at 650 °C. The lattice constant was found to increase from 10.663 Å to 10.667 Å. Coercivity and Retentivity are also found to increase but saturation magnetization was found to decrease.

Photoluminescence (PL) property of this sample was studied using 225nm, 250nm and 330nm excitation wavelength radiation source. The PL spectrum was obtained in visible range only by excitation through 225 nm and 250 nm radiation source.

Key words: Hexa-ferrite, Nanoparticles, Photoluminence, Magnetic behaviour

Introduction:

Strontium ferrite having general formula SrFe₁₂O₁₉ is a famous magnetic material which has a variety of applications in microwave devices and in permanent magnet^{1,2}. The electromagnetic wave absorption property of hexaferrite with a magnetoplumbite structure in the GHz range, which includes M-, W-, Y-, Z-, U- and X-type has found demands for microwave communication, microwave dark room target camouflage, electromagnetic radiation abatement, and so on³. In nanocrystalline form hexaferrites are of particular interest for use as high density perpendicular magnetic recording media^{4,5}.

Photoluminescence (PL) is nondestructive method of probing the electronic structure of material. The intensity & spectral content of this PL is a direct measure of various important material properties. The important applications are in materials quality,

impurity levels and defect detection, band gap determination and recombination mechanism⁶.

Many processes have been used to prepare strontium ferrite, including the solid state method⁷, Sol-gel^{8,9} and coprecipitation¹⁰ and other chemical processes¹¹. Among these processes, coprecipitation and sol-gel methods are more popular for the preparation of hard ferrite nanomaterials. Recently, the nanocrystalline Sr ferrite with mean particle size below 100nm has been prepared by sol-gel process using PVA(Polyacrylic acid) as a stabilizer.¹² However such a small particles size is still difficult to achieve by simple coprecipitation method. We have prepared small particle of size found 15.7nm at annealing temperature 450 °C and 20.3nm at 650 °C. The method of preparation was used Citrate precursor method.

Materials and Methods:

Samples of nanometer-sized Strontium hexaferrite powder were prepared by using the Citrate precursor method. Ferric nitrate, Strontium nitrate and Citric acid were taken in Stoichiometric proportion as starting materials. Aqueous solutions of these salts were prepared separately by dissolving the salt in minimum amount of deionized water while stirring constantly. The solutions were then mixed together. The mixture was heated to temperature between 60°C to 80°C for two hours with continuous stirring. This solution was allowed to cool to room temperature and finally it was dried overnight in oven in order to remove excess water and other impurities at 90-95°C until it formed a brown color fluffy powder. The Citrate precursor was heated at temperature 450°C & other sample at temperature 650°C for one hour in a muffle furnace. By this process, the precursor thermally decomposed to give Strontium hexaferrite powder of nanometer size.

Result and Discussion

Ferrite powders were characterized using X-ray diffractometer (XRD) for phases and mean particles size. The X-ray diffraction spectra shown in figures 1 & 2. We have chosen maximum intensity peak for particle size calculation and particle size observed was 15.7 nm and 20.3 nm at annealing temperature 450°C & 650°C respectively.

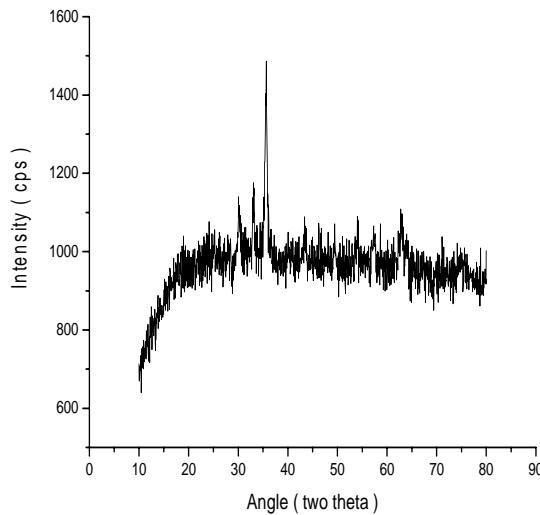


Figure1: X-raydiffraction pattern for $\text{SrFe}_{12}\text{O}_{19}$ annealed at 450°C

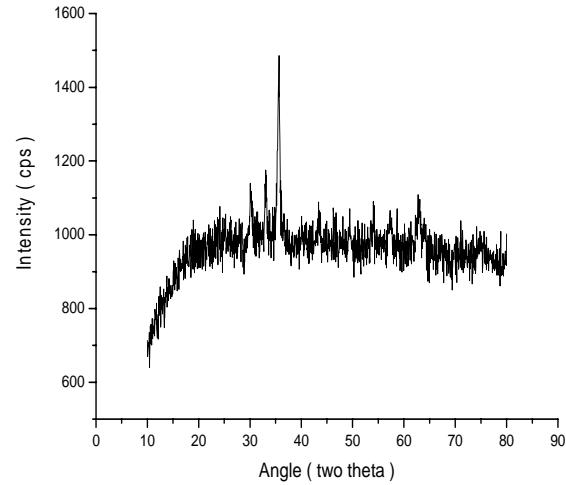


Figure2: X-raydiffraction pattern for $\text{SrFe}_{12}\text{O}_{19}$ annealed at 650°C .

The magnetic measurement of these nanometric particles was done using vibrating sample magnetometer. The magnetization curve are shown in

figures 3 & 4. The magnetic parameters are tabulated in table 1.

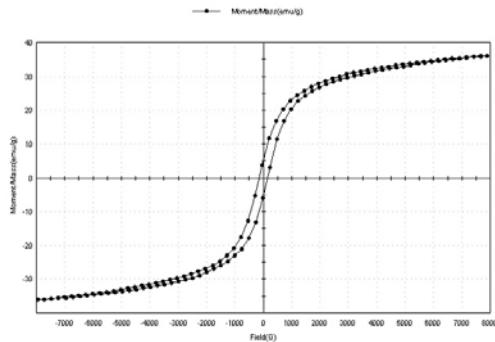


Fig 3: Hysteresis curve for Sr ferrite nanoparticles annealed at 450°C . **Fig 4:** Hysteresis curve for Sr ferrite nanoparticles annealed at 650°C

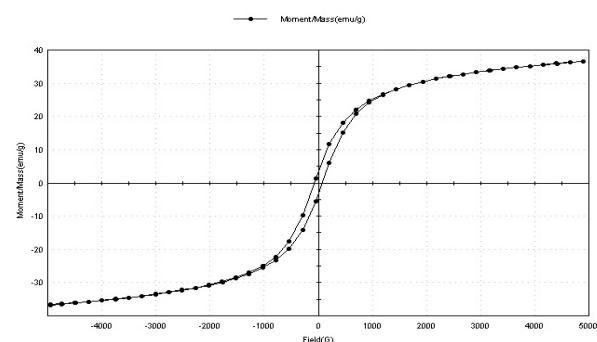


Table 1: Observed data for Sr ferrite nanoparticles.

Annealing temperature	Mean particle size	Lattice constant	FWHM	Coercivity H_c	Retentivity M_r	Saturation magnetization M_s
450°C	15.7nm	10.663 \AA	0.539	75.539 G	3.321 emu/g	36.615 emu/g
650°C	20.3 nm	10.667 \AA	0.423	157.04 G	5.665 emu/g	36.149 emu/g

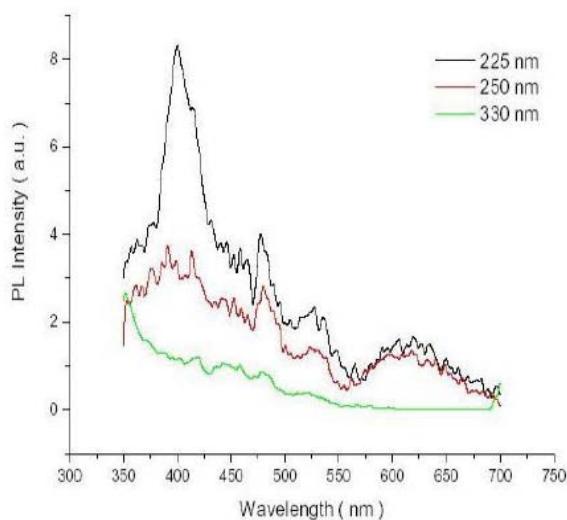


Figure 5: Photoluminescence spectrum of Strontium ferrite nanoparticles (annealed at 450 °C) under 225, 250 and 330 nm excitation.

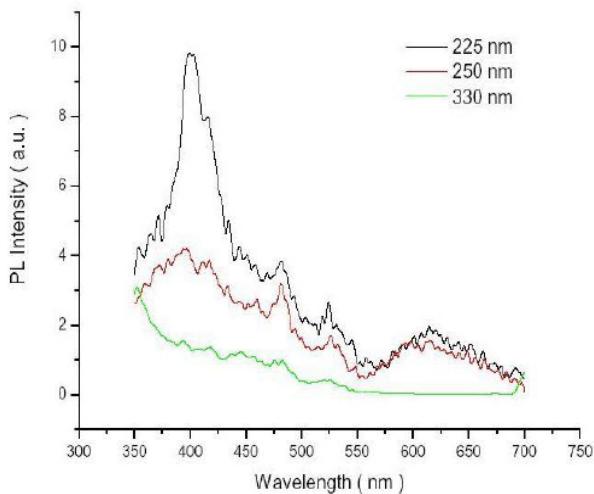


Figure 6: Photoluminescence spectrum of Strontium ferrite nanoparticles (annealed at 650 °C) under 225, 250 and 330 nm excitation.

The magnetic parameters such as coercivity, saturation magnetization, and retentivity of sample Strontium ferrite nanoparticles were obtained using VSM as 75.539G, 36.615emu/g, and 3.321emu/g at annealing temperature 450°C while 157.04 G, 36.149 emu/g and 5.665 emu/g at annealing temperature 650°C respectively. In the preparation of hexaferrite, a high annealing temperature is required to obtain pure phase . This results in significant increases of particle size together with improvement of ion occupancy¹³. Jun Wang et al. have reported that the Barium hexaferrite nanoparticles formed at 140°C in presence

of 0.25T magnetic field exhibited a higher saturation magnetisation i.e. 6.1emu/g at room temperature as compared with 1.1 emu/g obtained for sample prepared in zero magnetic field. V. K. Sankaranarayanan and D.C. Khan have reported in their work¹³ that magnetization first decreases with increasing annealing temperature, reaches a minimum for annealing temperature 690K(417°C), and then increases to reach a maximum for annealing temperature 720K(447°C), before decreasing again sharply to approach zero¹⁴. W. A. Kaczmarek et al¹⁴ found that annealing in air promotes slightly higher H_c value. They assume that different particle morphology, it directly responsible for fluctuations in magnetic parameters value. The value of coercivity increases over six times and reaches a value 445.6 kA/m. This value is typical of chemically coprecipitated fine hexa-ferrite powders, where perfect crystal structure assures a defect and stress-free spin arrangement with high magnetocrystalline anisotropy energy¹²

Photoluminescence is the emission of light from a material under optical excitation. When the light of sufficient energy is incident on a material, photons are absorbed and electronic excitations are created, after that these excitations relax and the electrons return to the ground state. If radiative relaxation occurs, the emitted light is called photoluminescence. The choice of excitation light is critical in any photoluminescence study of material. The excitation wavelength may influence the photoluminescence of any material as the absorption of a material depends strongly on the energy of the incident light. The excitation wavelength controls the density of photoexcited electrons and holes, which governs the behavior of these carriers. Figure 5 and 6 show the photoluminescence spectrum of strontium ferrite nanoparticles annealed at temperature 450 °C and 650 °C, respectively, at different excitation 225 nm, 250 nm and 330 nm. The photoluminescence spectrum consists of emission peaks at 400 nm (3.09 eV), 480 nm (2.57 eV), 530 nm (2.33 eV) and 650 nm (1.89 eV). These emission peaks seem due to different defects in Strontium ferrite nanoparticles. It is also observed that the emission intensity of the peaks depend on the excitation wavelength. Regarding the mechanism of PL, it may be due to quantum confinement. This confinement explain in terms of shortening of the superexchange interaction bond length in the nanocrystalline ferrite materials, which modifies the electronic structure of hexaferrite or by the presence of fast nonradiative relaxation channels in nanocrystals taking part at the surface¹⁶ PL around 3eV is indeed mainly due to the quantum confinement, because the peak value approximately agrees with band gap of ferrite nanomaterials¹⁷. The analysis of the PL

spectrum also should include the effect of the surface oxide and nonhomogenous sizes generally if there is a difference in the energies, which is associated with the stokes shift between the absorption- surface defects or surface oxide. The mechanism of charge transfer between the trivalent ion appears to involve a nonradiative, superexchange process via the intervening oxide ions, that support the ferromagnetic ordering¹⁸. As follows from the above discussion, the situation with the PL mechanism is very complex and is difficult to draw a definite conclusion about the PL mechanism at this stage. Further studies are needed in order to elucidate the correct mechanism of PL in hexa ferrite Nanoparticles.

Conclusion

We have prepared small particle size using Citrate precursor method. The annealing temperature 450°C & 650°C are also low in this method. The Coercivity and retentivity both increase with temperature while saturation magnetization slightly decreases. PL spectra in visible region shows only by excitation through 225 nm and 250nm radiation source. PL spectrum shows different colours in visible region and their intensities also found to decrease.

Acknowledgement: This research work was supported by the Nalanda Open University, Patna, India. We are thankful to Prof. H.C.Verma, Deptt of Physics, I.I.T Kanpur and Dr. R.K.Kotnala, National Physical laboratory New Delhi for constant encouragement.

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Study of Losses in Microstrip Transmission Line

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ABSTRACT

In this paper, characteristic impedance, Phase velocity, Attenuation constant and Selectivity, which are important parameters to be discussed. The metallic and dielectric loss has been also calculated for the study of selectivity of microstriplines with fused quartz as substrate and its variation with strip width and operating frequency-using computer added technique. The calculation of selectivity of the microstripline structure keeping strip width and permittivity fixed has been carried out for different frequencies. In the growing edge of computer and information technology the communication system has shrunk to a miniaturized size, lightweight and less expansive. It is due to advent of microwave integrated circuit, which gave birth to planar microwave transmission structure. Microstripline structure appears to be the most convenient and easy to fabricate. This furnishes very useful information for designing microstrip line coupler and resonators of high selectivity.

KEYWORDS: Microstripline, Attenuation factor, Selectivity

1. INTRODUCTION

The increasing importance of miniature planar microwave integrated circuits has renewed interest on the part of microwave circuit's designers in the various form of planar strip transmission line such as stripline, microstripline, slotline, coplanar stripline and coplanar waveguide etc. Out of these microstriplines appears to be most simple, convenient, inexpensive and easy to fabricate. Due to openness of the structure radiation, conductor and dielectric losses need to be minimized to insure the field to be confined near the metal strip. Use of dielectric substrate of suitable permittivity and low loss tangent is necessary. Also electromagnetic field lines extend in the space above the strip, the microstrip structure becomes a mixed dielectric transmission line. This needs effective permittivity to be taken into account.

The microstripline consists of a narrow "strip" conductor of width (W)and thickness(t) separated from a conducting ground plane by an intervening supporting dielectric substrate of thickness and width much greater than the strip width. For maximum circuit size reduction, the dielectric constant of substrates now being used is of the order of two or higher. But due to smaller loss tangent or low

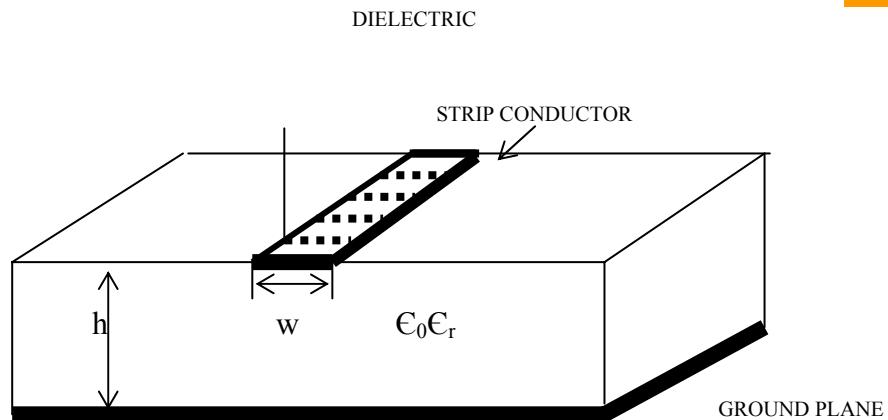
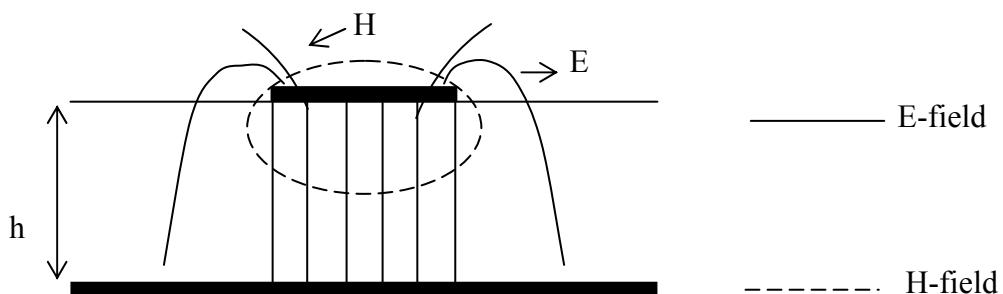
dissipation factor fused quartz like substrate is preferably used.

For design purpose it is necessary to study the characteristic parameters of the stripline and different losses occurred in this structure during the propagation of electromagnetic waves through the structure. The TEM-mode of the propagation is considered in the lower giga hertz range of frequency. This study provides and easy method for the calculation of the selectivity of the microstriplines using different width of the conductor strip.

As the study of selectivity of microstriplines has not received much attention in recent years. This restricts our attention to the study of variation of selectivity with strip width and operating frequency. This will furnish useful information for design of the microstriplines of given characteristic impedance operative at given frequency, microstriplines couplers and resonators of high selectivity.

2. BRIEFS OF MICROSTRIPLINE

This was realized with a planar form of single wire transmission line over a ground plane, called microstrip[1].Microstrip employs a flat strip conductor suspended above a ground plane by a low-loss dielectric material. The size of the circuit can be reduced through judicious use of a dielectric constant some 2-10 times that of free space (or air), with a penalty that the existence of two different dielectric constants (below and above strip) makes the circuit difficult to analyze in closed form (and also introduces a variability of propagation velocity with frequency that can be a limitation on some applications).Microstripline is an inhomogeneous structure. It consists of a narrow conductor strip one side of it a dielectric substrate and the other side being completely metalized to serve as a ground plane as shown in Fig-(1). Though the structure is open and suffers from radiation, metallic and dielectric losses, fused quartz substrate with copper conductor is used to minimize the losses. The microwave energy propagates both in the dielectric substrate below the metal strip and in the air region above. Fraction of power flows outside the substrate depending on the width of the metal strip. So, effective dielectric constant is considered instead of considering relative dielectric constant. The field configuration distribution is shown in fig-2. In the lower giga, hertz range of frequency TEM-mode of propagation of microwave is considered as proposed by H.A.Wheeler [2, 3].


Fig 1: Microstrip line

Fig 2: Microstrip Field configuration

3. CHARACTERISTIC IMPEDANCE

For the study of selectivity of microstriplines it is necessary to study the characteristic impedance and its dependence on the geometry of the microstriplines using Wheeler's conformal transformation technique which converts the microstrip geometry into parallel plate geometry [4, 5]. The knowledge of capacitance provides the knowledge of characteristic impedance of the microstrip geometry using formula

$$Z_0 = 1/V_p C \quad (1)$$

Where

V_p = Phase velocity of the microwave passing through the microstrip geometry and

C = Capacitance per unit length of the microstrip structure.

Considering the geometry of the (fig-1); Capacitance per unit length of the structure is given as:

$$C = (\epsilon_{re}/c\eta)w/h + (2/3)(\epsilon_{re}/c\eta)w/h + (\epsilon_{re}/c\eta)\{2.7/\log(4h/t)\} = \epsilon_{re}/c\eta [(5/3)w/h + 2.7/\log(4h/t)] \quad (2)$$

And the characteristic impedance is expressed as :-

$$Z_0 = \eta / \sqrt{\epsilon_{re}} [(5/3)w/h + 2.7/\log(4h/t)] \quad (3)$$

Where,

h = height of dielectric substrate

w = width of the metal strip.

t = thickness of the metal strip.

η = Free space impedance = 377Ω

ϵ_{re} = Effective dielectric constant of the medium = $(\epsilon_r + 1)/2$ for narrow strip.

Based on equation-3, a computer program has been developed and exhaustive computations have been carried out for calculations of characteristic impedance and its variation with width of metal strip in the lower giga hertz range of frequency. The result shows that for wider strip field concentration is larger below it causing larger flow of electromagnetic energy. As a result, characteristic impedance of the microstrip structure becomes smaller. But reverse is the case with narrow metal strip. This provides an useful information for the design of the microstrip structure of good selectivity.

4. CALCULATION OF LOSSES

4.1 SELECTIVITY

The selectivity or figure of merit of microstriplines is very significant characteristic need to be studied for the design of microstrip structure and its usefulness in couplers, circulators, resonators, antenna and coupled cavities of high selectivity. The selectivity depends on the losses taking place inside the structure during the flow of microwave energy. There are two important losses in this structure:

(i) Metallic loss

(ii) Dielectric loss

Assuming these losses per unit length to be small, the term attenuation factor α is used to represent this loss. Here α is written as:

$$\alpha = \alpha_c + \alpha_d \quad (4)$$

Where,

α_c denotes metallic loss and α_d denotes dielectric loss factor.

4.2 METALLIC LOSS

Pucel et al [6] derived the expression for α_c as;

$$\alpha_c = 8.68 (R_s / Z_0 w) \text{ dB/unit length} \quad (5)$$

Where,

$$R_s = \text{Surface resistivity}$$

$$= \sqrt{(\pi \mu f / \sigma_e)} \Omega/m^2$$

$$= 11.58 \times 10^{-3} \Omega/m^2$$

$$f = \text{operating frequency}$$

$$= 2 \text{ GHz}$$

$$\alpha_c = 1.7 \mu\Omega \text{ for Cu.}$$

$$\mu = 15.57 \times 10^{-7} \text{ H/m for Cu}$$

Putting different values of w and Z_0 , α_c has been calculated.

4.3 DIELECTRIC LOSS

Welch and Pratt [7] have established an expression for dielectric loss, further used by Pucel et al which is expressed as;

$$\alpha_d = (27.3 \tan \delta / \lambda_0) (\epsilon_r / \sqrt{\epsilon_{re}}) (-1/\epsilon_r - 1) \text{ dB/unit length} \quad (6)$$

Where, λ_0 = Free space wavelength
 $= 15 \text{ cm at } 2 \text{ GHz frequency.}$

$$\epsilon_r = 3.75$$

$$\tan \delta = 10^{-4}$$

for fused quartz

ϵ_{re} = Effective dielectric constant of the medium used.

$$= (\epsilon_{re} + 1)/2 \text{ for narrow strip.}$$

Calculating these losses selectivity can be studied. A simple formula for the selectivity of the microstrip line has been given by Delinger [8] and Schneider [9] and expressed as;

$$\text{Selectivity} = S = 27.3 / \alpha \lambda_g \quad (7)$$

Where, λ_g = guide wave length of microstrip line.

This shows that selectivity of microstrip line is the inverse of total loss factor and guide wave length. With the help of equation (4) total loss factor has been calculated and using equation (7) selectivity has been obtained. Further exhaustive computations have been carried out for obtaining selectivity for different strip width and different frequency. The variation of total loss factor with strip geometry is shown in Fig-(3).

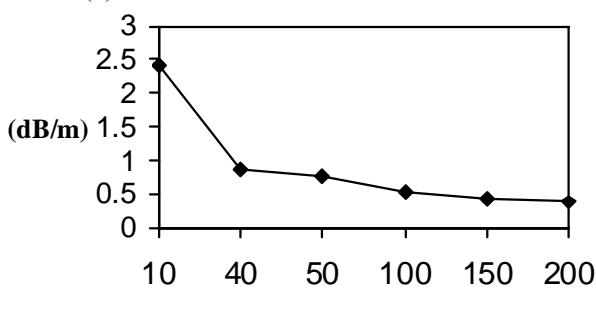


Fig.3: Variation of α with strip width

The selectivity has been plotted against strip width and operating frequency is shown in Fig-(4) & (5).

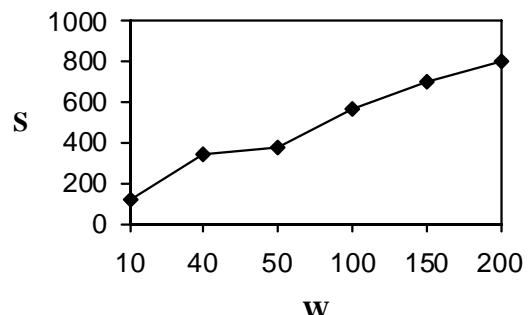


Fig.4: Variation of selectivity with strip width

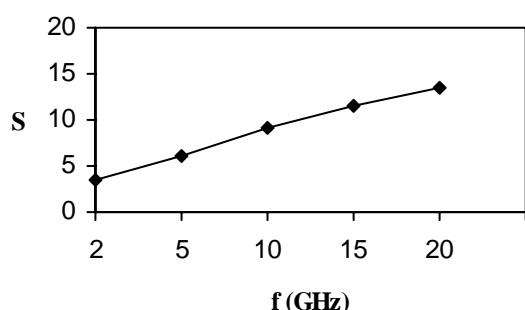


Fig.5: Variation of selectivity with operating frequency

5. RESULT & DISCUSSION

Variation of total loss factor with width of metal strip reveals that with increase of width total loss decreases sharply showing concentration of more and more energy below the strip in the dielectric medium. Also, guide wavelength shows a slight decrease with increase of width of metal strip. Further variation of selectivity of microstrip line shows a sharp increase in selectivity with increase of metal strip width. The calculations of selectivity of the structure keeping strip width and permittivity fixed have been carried out for different frequencies. The result has been plotted keeping frequency on X-axis and selectivity on Y-axis shown in Fig-(5). This shows that selectivity increases with increase of frequency. The rate of increase is almost the same in the lower GHz frequency range but becomes abnormal high in higher GHz frequency range of frequency dispersion effect is higher. Thus, selectivity is smaller for narrow strip and larger for wide strip. The selectivity of microstrip line using Copper strip and fused quartz dielectric substrate has been experimentally obtained by J.H.C.Van et al [10] which shows good agreement with the present results.

6. CONCLUSION

This concludes that wider metal strip is more useful for larger flow of power through the structure with smaller dissipation. But dispersion effect is

smaller in lower GHz frequency range than the higher GHz range of frequency. For higher selectivity or figure of merit and higher storing ability higher frequency, higher relative permittivity and wider metal strip are more useful. This study helps a designer to design and fabricate a practical microstrip transmission structure, which will be used in coupler, filter, and oscillator and antenna circuits. This work has the scope for future work also.

Acknowledgement

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Manufacture of Wireless Power Transmission Sheet using Printed Plastic MEMS Switches and Organic Field Effect Transistors

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Introduction

Wireless Power Transmission(WPT) is the process that takes place in any system where electric energy is transmitted from a power source to an electrical load, without interconnecting wires in an electric load. This could free cell phones, portable electronics from wired recharging. Moreover, it will lead to reduced reliance on batteries in some electronic devices.

The best known example of transmitting power wirelessly is electromagnetic radiation in the form of radio waves. Such radiation is excellent for wireless transmission of information but it is very inefficient for power transmission. Radio waves spread in all directions, so a vast majority of the power from such a source would be lost to the environment. The most common form of wireless power transfer is carried out using Inductive Power Transfer.

The first WPT experiment was carried out by Nikola Tesla at Wardenclyffe where he transmitted Alternating Current and was able to light lamps over 25 miles away without using wires. High frequency current of a Tesla Coil could light lamps filled with Ne.

The most important breakthrough during World War-II came when scientists developed ability to convert energy to microwaves using magnetron. In 1964, William Brown demonstrated a rectenna which can convert microwave power to electricity.

Ubiquitous Power Source Design with Microwave Power Transmission

We propose a Ubiquitous Power Source(UPS) with Microwave Power Transmission(MPT). For this, we use only carrier of the microwave to transmit the power. Microwave means wireless power transmission via microwave, such as 2.45 GHz-Band and 5.8 GHz-Band as ISM Band. We bring a receiving system, rectenna instead of heavy battery. The safety level must be under 1mW per sq cm. for continuous all over the human body. Against the safety level, we would like to get higher power from the microwave.

For the experiment, we have selected a magnetron and slotted antenna array for the transmitting system of the UPS. We use new rectenna array, receiving system for the microwave power transmission with higher efficiency under 1mW per sq cm microwave input. We adopted a Dual polarized antenna for the rectenna in order to

catch the microwave power from everywhere. The experiment will be done in the shielded room.

Design Target

For carrying out laboratory experiment of the UPS, we set a design target as follows:

1. Frequency= in ISM Band ex. 2.45 GHz
2. Input Electric Power<1 kW
3. Keep Safety level(<1 mW per sq cm)
4. Power density= Approx. Uniform
5. Economical System for promotion.

We chose the MPT system with 2.45 GHz magnetron & Waveguide Slotted Antenna for the experiment. The UPS is a better system to generate stable electric power in any condition than the solar cell.

Estimation of Power Density level by FDTD Method

Firstly we simulate the microwave power density in the shielded room by FDTD method. From the fig.1, the size of the room is 3.0 X 5.8 X 4.3 cm. and is shielded.

From the antennas in edges of the ceiling,

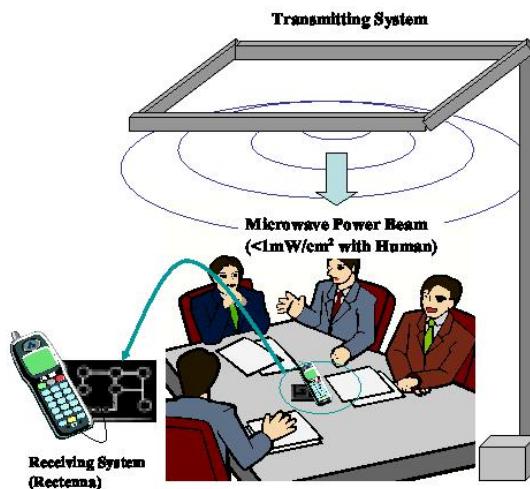
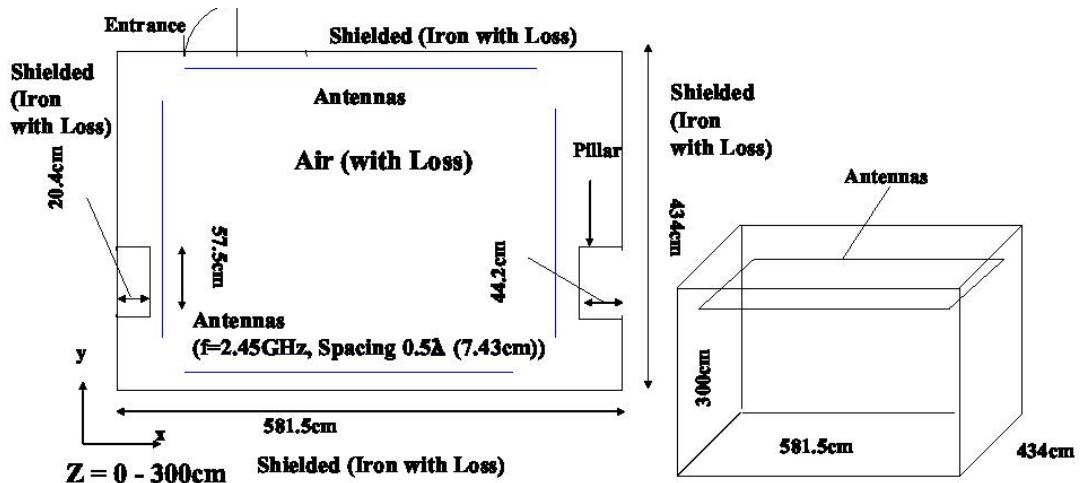


Fig.1 Concept of Ubiquitous Power Source

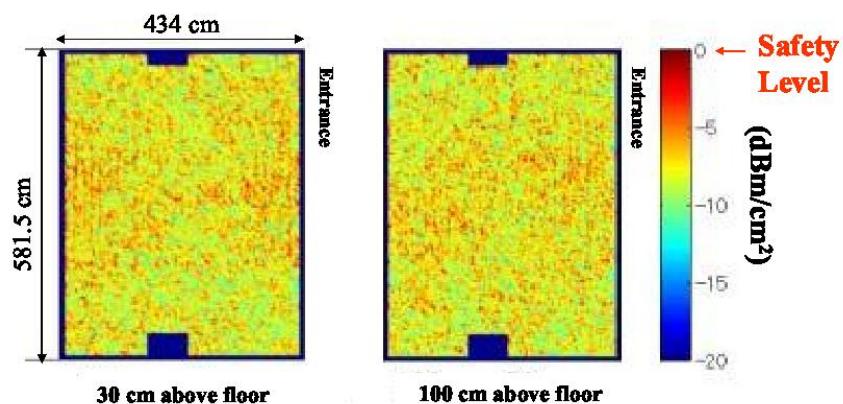
we emit the 2.45 GHz CW microwave. If we don't consider the power loss by air and the wall with conductor, the emitted microwave power will be accumulated and will be finally diffused. Therefore, we assume the power loss by air & the wall with conductor and estimate validity of the simulation. We conclude the simulation with loss leads valid results.

Simulation field for the UPS Experiment with FDTD Method

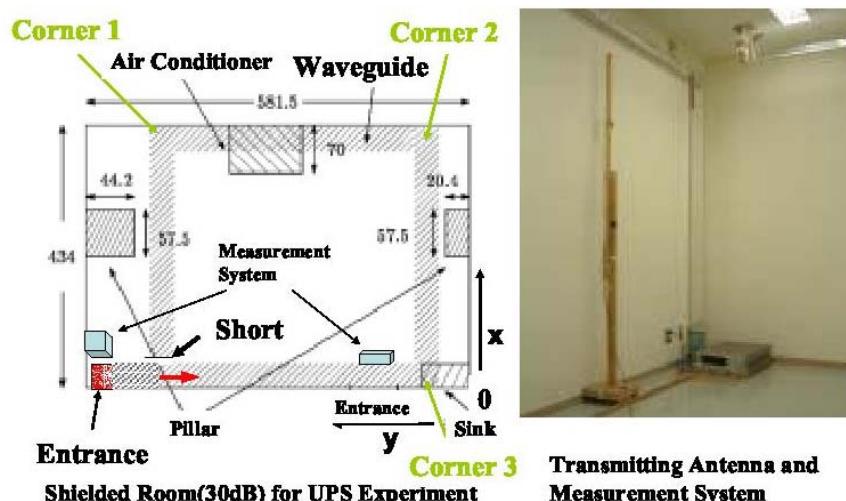


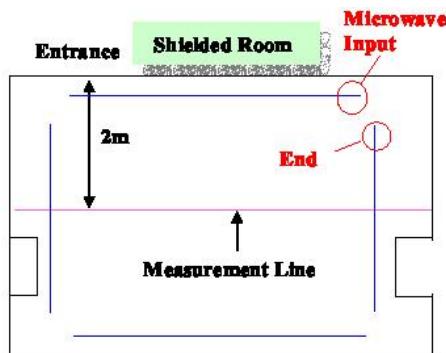
We now confirm that approximate power density was realized. We now adjust the total emitted microwave power in the condition that maximum power density was under 1 mW per sq cm.

Power Density in the Shielded room by FDTD Simulation



Experimental setup of the Ubiquitous Power Supply System





**Current Control Start Point
Transmitted Power : 34 dBm
Load Current : 45 mA**

In this way, Ubiquitous Power Source is constructed.

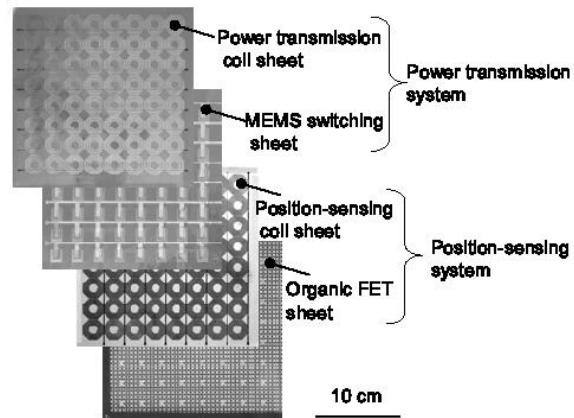
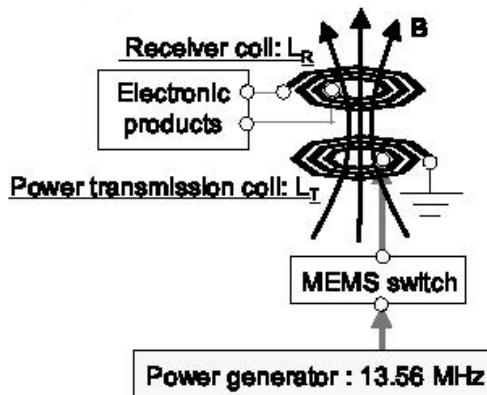
Manufacture of Wireless Power Transmission sheet using Printed Plastic MEMS Switches and Organic Field Effect Transistors

This paper is about manufacturing a large-area flexible wireless power transmission sheet using Printed Plastic MEMS Switches and Organic Field Effect Transistors. The position of Electronic objects on this sheet can be contactlessly sensed by electromagnetic couplings using an organic transistor active matrix. Power is selectively fed to the objects by an electromagnetic field using a plastic MEMS switching matrix. The System realizes a low-cost sheet-type wireless power source of more than several watts. This is the first step towards building infrastructure for ubiquitous electronics, where multiple electronic objects are scattered over desks, floors, wall and ceilings and need to be powered. These objects may be mobile or located in the dark.

And, therefore solar cells can't be used to power them. The proposed WPT Sheet will directly drive electronic objects or charge a rechargeable battery in the objects without a connector.

The wireless power transmission sheet has been manufactured on a Plastic Film by using Printing Technologies. The effective power transmission area is 21×21 sq cm. The sheet contains a two-dimensional array of 8×8 cells comprising position sensing and power transmission units. The position of electronic objects on the sheet can be contactlessly sensed by electronic coupling, using an organic transistor active matrix. Then, power is selectively fed to the objects by an electromagnetic field using a two-dimensional array of copper coils, that are driven by a Printed Plastic MEMS-Switching Matrix. Due to selective Power Transmission, a coupling efficiency of Power Transmission of 62.3% and a Power of 29.3W was received.

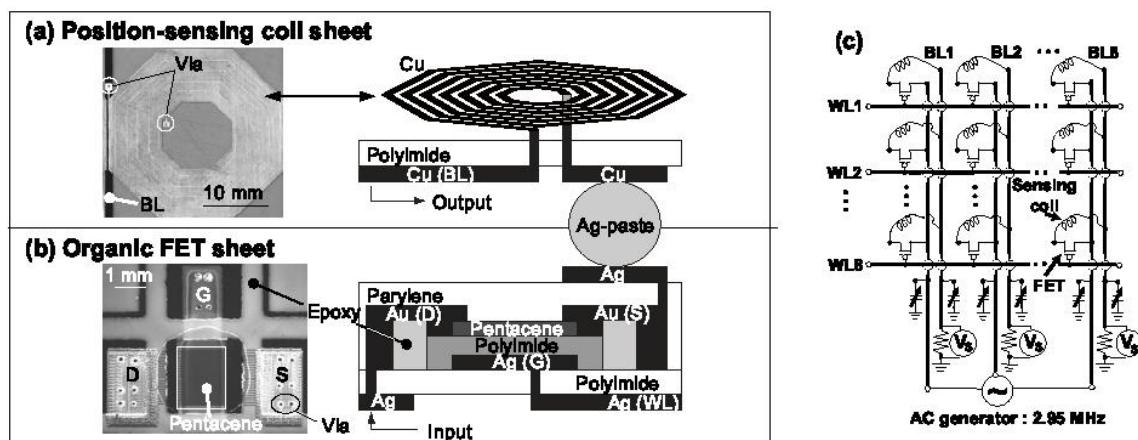
Device Manufacturing Process



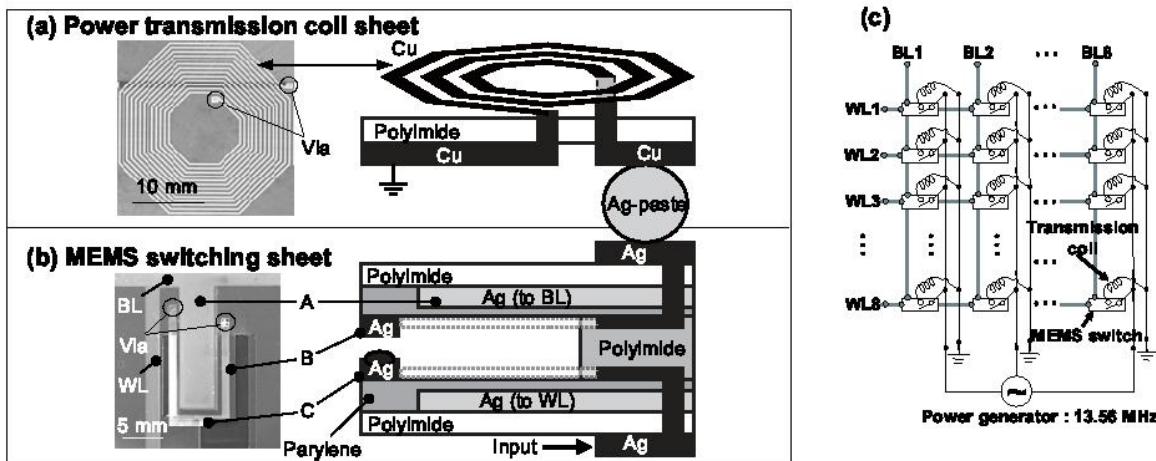
The entire system comprising 8×8 cells is manufactured by integrating the Position-sensing & Power Transmission Sheets. The periodicity is 25.4 mm. The contactless Position-sensing sheet comprises sheets of the Position-sensing coil array and Organic FET Active Matrix. An Organic FET Organic Active Matrix is fabricated on a Polyimide Film. Silver Gate Electrodes & Polyimide Gate Dielectric Layers are patterned by using inkjet printing. A Pentacene Channel Layer and Gold

source/drain electrodes are deposited in a vacuum. The channel length & width are $13 \mu\text{m}$ and $48 \mu\text{m}$, respectively.

A Position-Sensing Coil Array is manufactured by screen printing. The inner diameter of the copper coils is 10 mm. Both the width & spacing of the copper lines are $100 \mu\text{m}$. The no. of turns is 38. The inductance & resistance are $20 \mu\text{H}$ & 17Ω respectively.



The power transmission sheet comprises sheets of the Printed Plastic MEMS-Switches matrix and Power Transmission Coil array. The power transmission coil array comprises copper coils with an inner diameter of 10 m. Both the width & spacing of the copper lines are $300 \mu\text{m}$. The no. of turns is 13. The inductance & resistance are $3 \mu\text{H}$ & 17Ω respectively.



A MEMS Switching Matrix is formed by using inkjet printing and screen printing. The electrodes for power transmission and those for electrostatic attraction are patterned on a 25 μm thick Polyimide membrane.

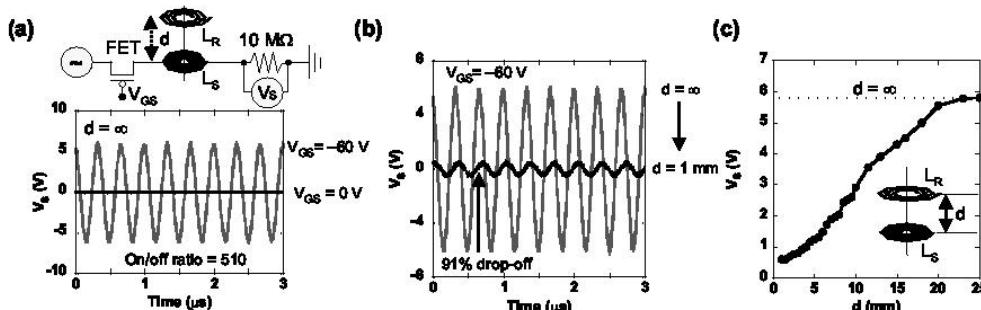
Device Characteristics

The contactless position sensing sheet: The Pentacene transistors in DC Characterization exhibit

mobility of 1 sq cm./Vs and an on/off ratio of 10000/1. A voltage of ± 10 V at a resonance frequency(2.95 MHz) is applied to the position sensing coils. The on/off ratio of the transistors at 2.95 MHz exceeds 500. When the distance between the position sensing coils and the receiver coil reduces, the change in output voltage increases and reaches 91%.

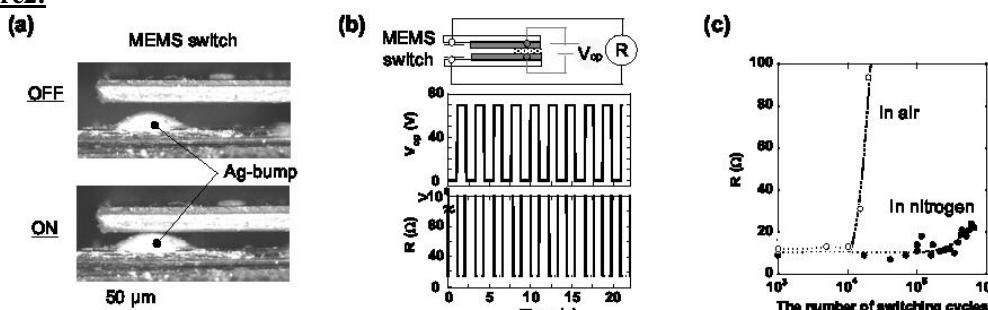
Following are the experimental diagrams:

Figure1:

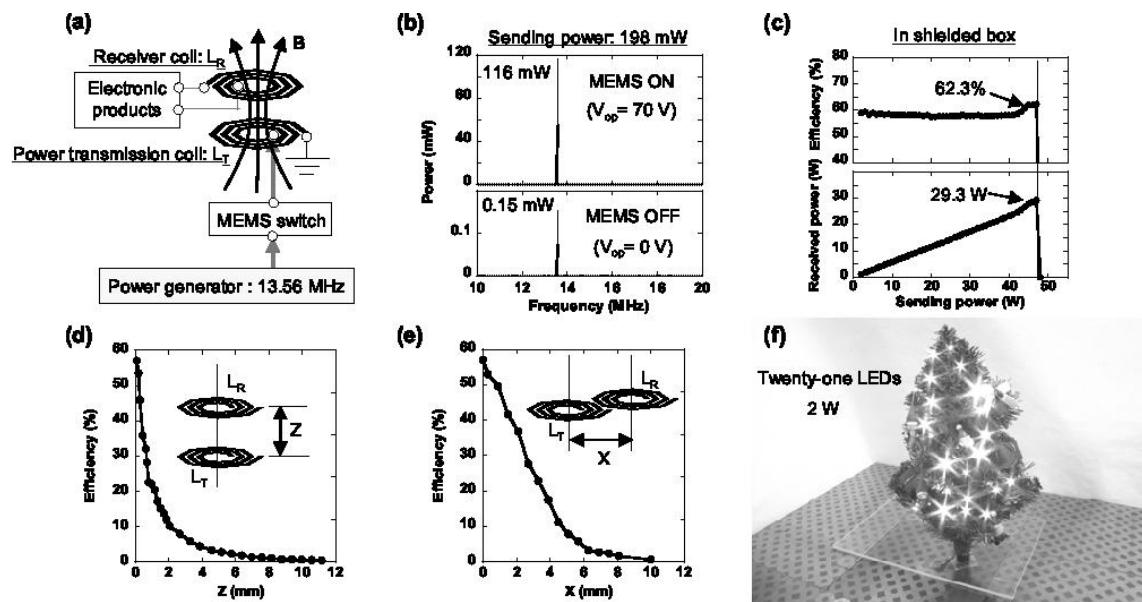


Position sensing. (a) Detected voltages (V_s) at gate voltage (V_{GS}) = -60 V and 0 V, where vertical distance d between the position-sensing coil (L_s) and the receiver coil (L_R) is infinite (∞). A voltage of ± 10 V at a resonance frequency (2.95 MHz) is applied to the position-sensing cells. (b) V_s at $d = \infty$ and 1 mm, where V_{GS} of -60 V is applied. V_s decreases as L_R approaches because of electromagnetic coupling. (c) V_s is shown as a function of d . A change in V_s of 91% is attained at $d = 1$ mm. The dashed line represents the voltage at $d = \infty$.

Figure2:



Stand-alone plastic MEMS switch. (a) Micrograph of cross-sectional surface of MEMS switch. Top electrodes for power transmission are connected to bottom electrodes when the operation voltage (V_{op}) is applied to electrodes for electrostatic attraction. (b) When a rectangular wave of $V_{op} = 70$ V is applied to the MEMS switch, the resistance changes from $>10^6 \Omega$ to 15Ω and the frequency response extends up to 4 Hz. (c) MEMS switch resistance is shown as a function of the number of switching cycles.

Figure3:


In this way, Wireless Power Transmission sheet is manufactured which is a great technological advancement for our mankind.



Popularizing Physics Through Low Cost/ No Cost Experiments

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There has been a general deterioration in the level of understanding of science in India although many research institutions have been established nation-wide. This can be attributed to a lack of scientific culture. We present here a very effective method that creates interest in science, especially Physics with help of Low-cost / no cost experiments. In this paper four experiments are presented out of many that we have been using in Physics shows. These shows have been given to a variety of audiences and have been very effective in attracting students towards science.

The first half of the twentieth century saw tremendous development of scientific research in India marked by the remarkable achievement of J.C.Bose, C.V.Raman, S.N.Bose, M.N.Saha and many others. In the second half of the 20th century a number of research institutions were established with intention of focussing on high quality scientific research. The outcome, however did not come up to the expected level. For quite some time the undergraduate teaching and scientific research activities in Indian universities has been passing through a state of inertia. Although new institutions such as Indian Institute of Science Education and Research (I.I.S.E.R.) and National Institute of Science Education and Research (N.I.S.E.R.) specializing in high quality Science Education and Research have come up, the interest in science at mass level is poor, so popularizing science and making science teaching thrilling is a great challenge.

Physics is one of the basic Physical Science. It is the impression of most of the students that this subject is difficult and dreary. The engineering and medical entrance examinations have converted this very important subject into a long list of facts to be memorized and problems to be solved. Most of the students go through their school and college education with somewhat this kind of impression. But Physics is much more than this. The subject can be presented to the students in a manner that makes it much more interesting and brings it closer to real life. We have worked with Dr. H.C. Verma, Department of Physics, IIT Kanpur, to develop a simple low-cost demonstration of experiments in Physics that can be used in class-rooms to stimulate lively discussions in science. Some innovative low cost / no cost physics

experiment for class room demonstrations and informal lab activities are given below.

- **How much is one newton force?** We read about different units in our textbooks. Often we have no idea how much the different units mentioned in our text books represent. A very simple live demonstration can be used to illustrate this point. If you ask the students in a class to apply a force of one newton on a body, you will find them typically applying a force ten times larger. Only one or two students will make the mental estimation that the weight of a 100g body is 1 N. This can be demonstrated by taking a single pan balance and asking different students to press it down applying 1 N force. The observations will be revealing.
- **What is your reaction time?** When we are faced with a situation, we do not respond to it instantly. We take some time to react. Reaction time is defined as the time taken by a person to notice and act in response to a stimulus. The following simple experiment gives an idea of typical reaction time. A meter scale is held vertically with the hand. The subject is asked to keep his hand near the bottom end of the scale so that he can catch it as soon as it is released. The scale is suddenly released without warning. It falls down a certain distance before the subject realizes this and catches it. The time duration between the release of the scale and catching it can be calculated from the distance that the scale has fallen through. If this distance is d then time taken is $t = \sqrt{2d/g}$. This is the required reaction time.
- **Total Internal Reflection demonstration:** When light goes from a denser medium to a rarer medium, the light will get fully reflected from the surface if the angle of incidence is larger than a critical angle,. If the angle of incidence is smaller than the critical angle, part of light is reflected back and part of it refracted. This is very effectively demonstrated using a laser torch and a small glass bottle. The bottle is half filled with water in which a very small amount of soap has been dissolved. The upper part of the bottle is filled with smoke from burning incense stick. Laser light is thrown at an angle from below at

the surface of the water. Due to the presence of soap the path of laser beam in water is visible. It is clearly observed that when the angle of incidence is greater than critical angle, there is total internal reflection while for angle of incidence less than critical angle there is only partial reflection and partial refraction.



Fig 1: A demonstration of total internal reflection of light

- **Demonstration of electromagnetic damping:** Electromagnetic damping is the slowing down of a moving magnet near a conductor due to induced current. This can be demonstrated by

using a strong magnet and an aluminium tube. The aluminium tube is kept vertical. When a strong magnet is released inside the tube from the top, it is observed that the magnet takes considerable more time to fall through the tube, compared to what a non-magnetic body will take to fall through the same tube. This slowing down is due to the strong eddy currents produced in the aluminium tube due to electromagnetic induction when subjected to moving magnetic field. The magnet in turn experiences a force that opposes the relative motion.

The above four are examples of the low cost demonstrations experiments that can be used to enliven Physics teaching and create interest in Physics through shows and demonstrations. We have worked with Dr. H.C. Verma, IIT Kanpur to develop a number of low-cost Physics experiment kits and conducted workshops on effective use of the classroom demonstrations for science-teaching. We have conducted shows with help of these and many other experiments. These shows have attracted attention of students and encouraged them to ask relevant questions in science. Such efforts help in demystifying science and developing scientific thinking in students.

Route Simulator

Saumya Priyadarshini; Akanksha Anand; Abhimanyu Kumar

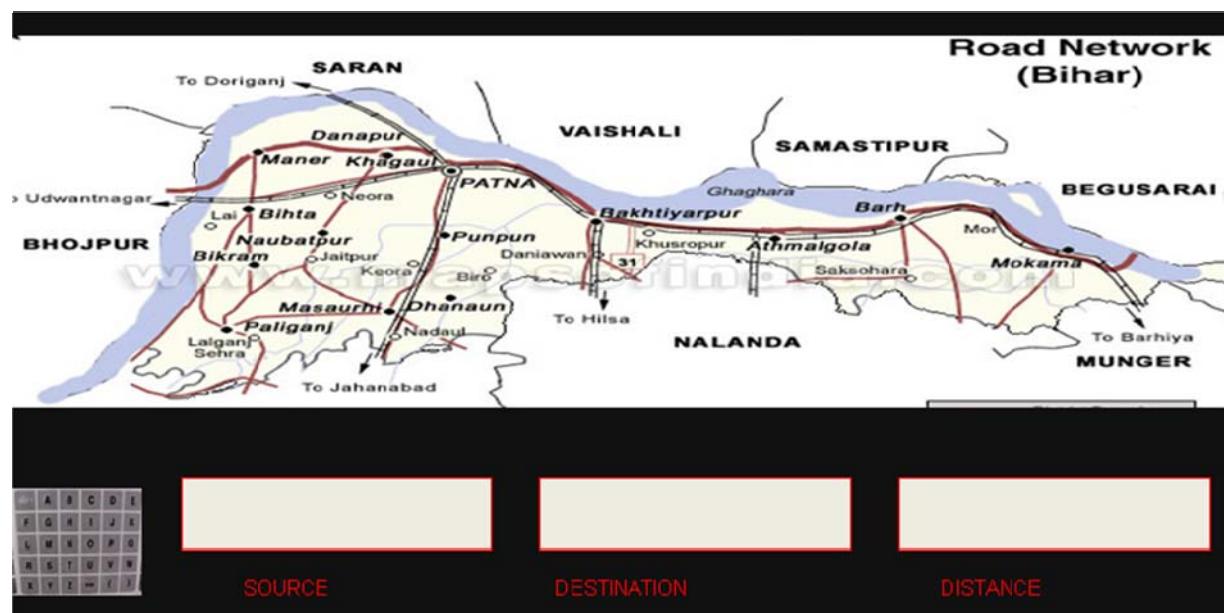
(Department Of Computer Science & Engineering)

R.P.S.I.T. Patna

It is very difficult to decide a suitable path over which you can travel from one place to another under optimal cost (minimum traveling cost, through minimum distance, minimum time taken). There are many solutions available to solve this type of problem, like using road map, Internet surfing, or any other latest modern technique etc. But all of these are feasible on large geographical area, or these are beyond the reach of the common man .Similar situations come in our daily life when one wants to go to a desired place under a small geographical

area , e.g. within a state or within entire city and he is a new person for that city as one may not be familiar to the sub-destinations coming under the path , the traffic rules of that particular area and any new disturbance in that path (may be due to construction work or other natural calamity) .These situations make traveler confused .

To overcome this problem, we have designed a software based device; named “**ROUTE SIMULATOR**”. Its virtual image is shown below:



The device consists of a keypad through which inputs are feeded. This device takes two inputs from the end user ,that is **source** & **destination** ; and provides two outputs : one of these is **distance** and next and the most important one is the **representation of shortest path** including all sub-destination on the display. This device is having map based information of the geographical area(city/state /as required) in the form of weighted graph. Internally ,each place is represented as a node and distance between the two places is taken as edge of the graph.

The software on which this device works is based on “**Djikstra’s Algorithm**”. It is a very popular and common purpose algorithm provided with *Graph data structure* .The algorithm is as follows :

Algorithm DjikstraDistances(G, s)

```

 $Q \leftarrow$  new heap-based priority queue
for all  $v \in G.vertices()$ 
  if  $v = s$ 
    setDistance( $v, 0$ )
  else
    setDistance( $v, \infty$ )
   $l \leftarrow Q.insert(getDistance(v), v)$ 
  setLocator( $v, l$ )
while  $\neg Q.isEmpty()$ 
   $u \leftarrow Q.removeMin()$ 
  for all  $e \in G.incidentEdges(u)$ 
    { relax edge  $e$  }
     $z \leftarrow G.opposite(u, e)$ 
     $r \leftarrow getDistance(u) + weight(e)$ 
    if  $r < getDistance(z)$ 
      setDistance( $z, r$ )
       $Q.replaceKey(getLocator(z), r)$ 

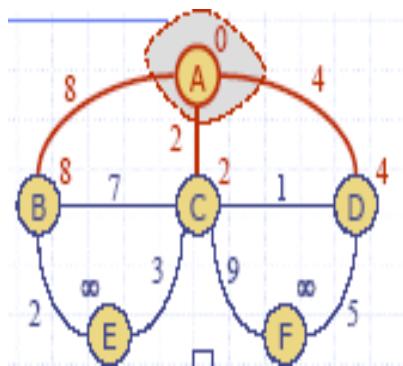
```

The algorithm typically relies on the property that a shortest path between the vertices contains other shortest paths within it.

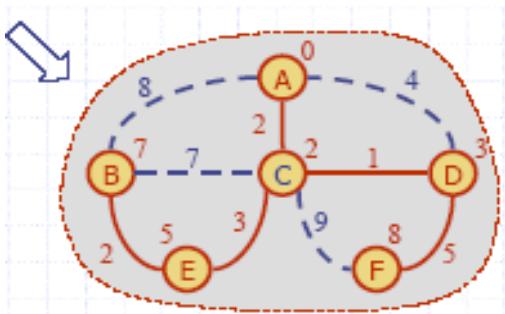
For example , graph before and after processing algorithm are as follows:

[Here the vertex ‘A’ is source and all others are treated as destinations].

Initial :



After processing a series of operations:



The representation of screen by highlighting the shortest path is managed by “**graphics under ‘c’ language**.”

There are many advantages of this device which make it more feasible for common people :

- It follow the traffic rules.
- It is a perfect guide .
- Gives current updates of a path.
- It is quit reliable.

To make this device reachable to the common man , we have planned that it should be implemented as “Display Devices” on the public places like Bus stop, Railway station, front of Tourist center or government buildings etc. This can also be used in the inquiry office so that the people can have online help about the routes. Current updating due to any disturbances can be managed by route department government (e.g. PWD Dpt.) by setting the ‘weight’ of that path to ‘infinite’ in the ‘graph’.

This device doesn’t work on any radar or satellite concept, so it is not very expensive and is reliable too.

Dissipation of Two Pyrethroids on Pigeonpea Crop (*Cajanus Cajan L.*)

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Materials and Methods

ABSTRACT

Field trials were undertaken to determine efficacy and residues of fenpropathrin and fluvalinate in/on Pigeonpea. The objective of investigation was estimation of residues of these synthetic pyrethroids, in order to judge whether the pesticides residues found at harvest on pigeonpea were acceptable for human consumption. Fenpropathrin and fluvalinate were sprayed separately @ 80 and 160 g.a.i.ha⁻¹ and 40 and 80 g.a.ha⁻¹, respectively at flowering stage and repeated a pod formation stage. Residues were determined in/on the pigeonpea foliage, pods, straw and grains. Effect of decontamination process on the dissipation of residues was also studied with growth and yield of pegeonpea.

Keywords: *Cajanus Cajan L.*, Decontamination, Fenpropathrin, Fluvalinate, Yield.

Pigeonpea (*Cajanus Cajan L.*) is the second most important pulse crop next to chickpea in India. Covering an area of about 3.82 million ha, a total production of 2.88 million tones. It account for about 13% of the area and contributes 19% of the total pulse production of the country. The production of pigeonpea (*Cajanus Cajan L.*) is low as compared to other pulse crops. The low productivity is mainly due to several pest infestations during the crop growth stages. The damage is especially by pod borer (*Helicoverpa armigera* Hubner). All India Co ordinate Pulses Improvement Project recommended the use of fenpropathrin [(R,S)- α -cyano-3-phenoxy benzyl-2,2,3,3-tetramethyl cyclopropane carboxylate] and fluvalinate [(R,S)- α -cyano-3-phenoxybenzyl (R)-2(2-chloro-trifluoromethyl aniline)- 3-methyl butanoate] for the control of pod borer complex of pigeonpea. A detailed study on dissipation of fenpropathrin and fluvalinate on pigeonpea is not available pertaining to Indian agro climatic conditions expect by Kaushik and Handa (1993) and Mukherjee and Gopal (1996). Since these insecticides will be applied at the pod formation stage, it was therefore, considered desirable to study, dissipation of these insecticides on pigeonpea plant and their residues in grain, straw and pod cover. Effect of various decontamination processes on the dissipation of residues has also been studied.

The dissipation and effect of fenpropathrin and fluvalinate was carried out in/on pigeonpea at the experimental field at Magadh University during Rainy season of 1998-1999 using pigeonpea . P 606 in sandy loam soil. Rate of application of insecticides, fenpropathrin were 80 g.a.ha⁻¹ @ 700 L ha⁻¹ and 160 g.a.i.ha⁻¹ @ 700 L ha⁻¹ and that of fluvalinate were 40 g.a.i.ha⁻¹ @ 700 L ha⁻¹ and 80 g.a.i.ha⁻¹ @ 700 L ha⁻¹. The step involved in the residues analysis of insecticides was extraction, cleanup and estimation. A representative sample (25g) was taken for analysis. Pigeonpea leaves and pods were separately churned with 50 ml. solvent mixture (1:1, n-hexane: acetone, v/v) is a waring blender for 2 min. at high speed, the homogenized material was filtered through Buchner funnel. Both the extract were combined and transferred in to 500 ml separatory funnel, diluted with 200 ml of 2% sodium chloride solution and shaken for two min. The phases were allowed to separate and the aqueous layer was discarded. The hexane layer was drained through 2 cm layer of anhydrous sodium sulphate and was concentrated to about 25 ml in a rotary vacuum evaporator. For extraction from pigeonpea grain, dry pod cover and straw, a representative sample (25g) was powdered in a grinder and then, placed in Soxhlet extraction thimble. Enough quantity of n-hexane was added to permit syphoning.

For clean up of pigeonpea foliage and pod samples, 45 ml of n-hexane extract, 5 ml of acetone and 1.5 g of activated charcoal were added. The colourless extract obtained was filtered and the residues were washed with (3x15 ml) of n-hexane: acetone (9:1) mixture. The extract was concentrated and dissolved in n-hexane for GLC analysis. By n-hexane extracts of pigeonpea grain were concentrated and cleaned by acetonitrile partitioning technique followed by clean up with activated charcoal.

Fenpropathrin and fluvalinate residues were determined by using a GLC equipped with ECD ⁶³Ni with following operational parameters for both the insecticide, oven temperature 270⁰C, injector temp 290⁰C, detector temp 300⁰C, carrier gas N₂ 60 ml min⁻¹, chart speed 0.5 cm min⁻¹, injection volume 3 ml. The efficiency of extraction, partitioning and clean up was done by fortifying the substrates viz., folialge, pods, grains and analysing the samples in triplicate. Interpretation of residues data and working

out regression equation was done following Hoskin (1961). RL_{50} was the time in days required to reduce the insecticidal residues to half of its initial deposit.

Decontamination of pigeonpea pod sample of 0 day and 5 days after second spray were subjected to following decontamination process (a) washing: pigeonpea pod samples (50 g) were washed by rubbing with hands under tap water for one min. (b) cooking: pigeonpea pod (50 g) were boiled for 15 min. using enough quantities of water to cover the samples (about 60 ml for 50 g pods).

Result and Discussion

The initial deposit of fenpropathrin on pigeonpea foliage when sprayed @ 80 g.a.i.ha⁻¹ at flowering stage as 4.35 ppm which dissipated to 4.18 ppm after one day representing 3.90% loss of residues. The residues on pigeonpea foliage recorded in 5, 10 and 15 days were 1.19, 0.60 and 0.22 ppm respectively and loss of percentage residues were 72.64, 86.20 and 94.95 %. When treated @ 160 g.a.i.ha⁻¹ on pigeonpea. The initial deposit 5.06 ppm fenpropathrin degraded to 4.75, 1.93, 0.90 and 0.34 ppm after 1, 5, 10 and 15 days respectively which corresponded to 6.07, 65.90, 84.09 and 93.99 % reduction in the residues. The residues of fenpropathrin (80 g.a.i.ha⁻¹) on pigeonpea pods at second spray at different time intervals were presented in table-1. The initial deposit of fenpropathrin on pigeonpea pods were 1.73 ppm. The residues at the end after 1, 5, 10 and 15 days were 1.19, 0.56, 0.22 and 0.08 ppm respectively indicated that corresponded to dissipation of residues by 31.21, 67.63, 87.28 and 95.37 %. The initial deposit of fenpropathrin (160 g.a.i.ha⁻¹) on pigeonpea pods collected after 1 hr. of second spray was 4.03 ppm. It declined to 3.32, 2.06, 0.47 and 0.15 ppm after 1, 5, 10 and 15 days respectively. The rate of dissipation of fluvalinate at all the labels of treatment were statistically similar (Table-1). Similar trend of dissipation was observed by Tanwar and Handa (1998).

The decontamination processes presented in Table-2 shown that initial deposit of 1.34 and 3.12 ppm from the treatment of fenpropathrin @ 80 and 160 g.a.i.ha⁻¹ on pigeonpea pods, were reduced by 35.82 and 37.50 % by washing and residues left after washing were 0.86 and 1.95 ppm respectively. By cooking residues deposits 0.34 and 0.49 ppm and percentage reduction 74.62 and 84.29 % respectively. The residues of fenpropathrin (80 and 160 g.a.i.ha⁻¹) on 5th day pods samples washing led to a reduction of 39.34 and 20.16% respectively. The corresponding reduction in value of residues after cooking on 0 and

5 day were 74.62, 84.29 and 91.80 and 87.33% respectively. From treatment of fluvalinate @ 40 and 80 g.a.i.ha⁻¹ washing of 0 (1 hr.) day pigeonpea pods having initial deposit to 0.93 and 1.66 ppm could be removed by 41.93 and 50.60% respectively, while in case of day 5 sample 23.07 and 16.39% residues could be reduced. The corresponding reduction in fluvalinate residues after cooking pigeonpea pods on 0 and 5th day were 87.09, 85.54% and 94.87, 63.93%. The terminal residues data obtained collectively for straw and pod cover and for grain of pigeonpea after harvest, i.e. 20 days after second spray of fenpropathrin following application of two dosage were 0.57 and 1.41 ppm respectively, Table-2. The corresponding residue of fenpropathrin in pigeonpea grain were below detectable label (<0.1 ppm). The terminal residues of fluvalinate following application of 40 and 80 g.a.i.ha⁻¹ on straw and pod covers were found to be 0.68 and 1.41 ppm respectively and the corresponding values in pigeonpea grain were 0.02 and 0.06 ppm.

Relative efficacy of fenpropathrin and fluvalinate for the control of pod borer complex of pigeonpea was reflected in the yield of pigeonpea grain. The grain yield of pigeonpea in control was 10.58 q ha⁻¹, when treated with fenpropathrin (80 and 160 g.a.i.ha⁻¹) and fluvalinate (40 and 80 g.a.i.ha⁻¹) these were 17.85, 18.35 and 13.80, 15.19 q ha⁻¹ respectively. All the treatments gave significantly higher yield than control and residues is also below detectable limit. Application of fenpropathrin (160 g.a.i.ha⁻¹) recorded maximum yield of chickpea as also observed by Bhagwat and Wightman (2001).

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Table No. 1 Dissipation of Fenpropothrin and Fluvalinate in/on Pigeonpea

Normal Dose

Days	Folige			Y	Pods			Y
	*Residues (ppm) Av.	± SD	RL ₅₀		*Residues (ppm) Av.	± SD	RL ₅₀	
Fenpropothrin								
0	4.35	0.35	3.17 days	1.4603-0.2016X	1.73	0.90	3.20 days	0.4450-0.1955X
1	4.18 (3.90)	0.41			1.19 (31.21)	0.06		
5	1.19 (72.64)	0.06			0.56 (67.63)	0.04		
10	0.60 (86.20)	0.04			0.22 (87.28)	0.02		
15	0.22 (94.95)	0.02			0.08 (95.37)	0.01		
Fluvalinate								
0	4.74	0.13	3.41 days	1.4978-0.2199X	0.88	0.03	4.15 days	8.3137-0.2063X
1	3.98 (16.03)	0.10			0.78 (11.36)	0.03		
5	1.20 (74.68)	0.05			0.40 (54.54)	0.03		
10	0.48 (89.87)	0.02			0.08 (90.90)	0.01		
15	0.18 (96.20)	0.03			0.05 (94.31)	0.05		

* Average three replication

Y Regression equation

 RL₅₀ Residues limit

Value in parentheses are % decrease

Table 1 contd...

Days	Double Dose								Y
	*Residues (ppm)		Folige		Y	*Residues (ppm)		Pods	
	Av.	± SD		RL ₅₀		Av.	± SD		RL ₅₀
Fenpropathrin									
0	5.06	0.03	3.23 days	1.6564-0.1815X	4.03	0.10	5.2 days	1.5115-0.2223X	
1	4.75	0.52	(6.07)		3.32	0.07			
5	1.93	0.16	(65.90)		2.06	0.06			
10	0.90	0.05	(84.09)		0.47	0.02			
15	0.34	0.03	(93.99)		0.15	0.01			
Fluvalinate									
0	8.30	0.05	2.91 days	2.0352-0.2477X	1.61	0.03	3.17 days	0.4604-0.1994X	
1	5.43	0.22	(34.57)		1.19	0.05			
5	2.31	0.58	(77.46)		0.61	0.03			
10	0.68	0.02	(91.80)		0.21	0.02			
15	0.20	0.01	(97.59)		0.08	0.01			

* Average three replication

Y Regression equation

RL₅₀ Residues limit

Value in parentheses are % decrease

Table No. 2 Effect of various decontamination process, yield and terminal residues of fenpropathrin and fluvalinate in/on pigeonpea pods

Days	Decontamination Process	Fenpropathrin				Fluvalinate			
		80 g.a.i.ha ⁻¹		160 g.a.i.ha ⁻¹		40 g.a.i.ha ⁻¹		80 g.a.i.ha ⁻¹	
		Residues (ppm)	± SD	Residues (ppm)	± SD	Residues (ppm)	± SD	Residues (ppm)	± SD
0	Initial Washing	1.34 0.86 (35.82)	0.04 0.27	3.12 1.95 (37.50)	0.94 0.98	0.93 0.54 (41.93)	0.03 0.18	1.66 0.84 (50.60)	0.45 0.44
	Cooking	0.34 (74.62)	0.54	0.49 (84.29)	0.95	0.12 (87.01)	0.27	0.24 (85.54)	0.02
	Initial Washing	0.61 0.37 (39.34)	0.48 0.44	1.19 0.95 (20.16)	0.91 0.87	0.39 0.30 (23.07)	0.24 0.23	0.61 0.51 (16.39)	0.21 0.16
	Cooking	0.05 (91.80)	0.45	0.15 (87.33)	0.86	0.02 (94.87)	0.28	0.06 (63.93)	0.22
Grain yield (Control) (q/ha ⁻¹)		**10.58 ± SD 0.60	**17.85	0.26	**18.35	1.03	**13.80 0.53	**15.19 1.14	0.43 0.38
After harvest	Terminal Straw Residues + Pod cover	0.57	0.28	1.41	0.12	0.68	0.25	0.06	0.01
	Grain	BDL		BDL		0.02	0.01		

Residues ppm average of three replication

** Yield of grain

BDL = Below Detectable Limit

Studying Geophysics in India

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Geophysics is an applied science that uses principles of physics to solve the problems related to the Earth and Planetary sciences such as earthquakes, volcanoes and exploration of mineral resources. It can be broadly divided into two branches: 1) solid earth geophysics, and 2) exploration geophysics. Solid earth geophysics is the study of the origin and interior structure of the planet earth and various processes that are changing the shapes of the earth; the scope of this branch is vast as it includes study of shallow to deep earth, earthquakes to moonquakes and also extends to the ocean and climate systems. Exploration geophysics focuses on applying geophysical methods to explore for (find and map) energy resources such as oil, coal, and uranium, and other mineral resources such as iron ore, gold, diamond, etc inside the earth. Exploration geophysicist studies the physical property of shallow subsurface up to few kilometers below the surface in search of mineral resources. Geophysical exploration methods remotely image the subsurface in terms of their physical properties (elastic moduli, density, electric and magnetic properties) and look for anomalies in the search of energy and mineral resources. Commonly used geophysical methods are: seismic, gravity, electrical, magnetic and electromagnetic. Each of the method has its own advantages in terms of minerals to be explored, required resolution and depth of penetration. For example, seismic method has become popular for oil exploration as it provides high resolution images of subsurface and helps in locating petroleum reservoirs. Similarly, gravity and magnetic methods are used for searching mineral resources while electrical and electromagnetic methods are commonly deployed for mapping water resources. As the easy exploration targets are exploited, there is a push to use various methods together in integrated analysis in exploration for difficult anomalies. These geophysical methods are also used for studying the structure of the earth. For example, the information about the earth's deep interior is derived from the seismic signal produced during an earthquake. Magnetic and gravity methods help in understanding the crustal structures and movement of continental and oceanic masses, formation of mountains and deep trenches. It is evident that geophysics is a very important and diverse subject, and it has a significant role to play in the two most important issues in future: energy and global environment.

Historically, geophysics has been taught in postgraduate level (Master/PhD) courses in India and abroad. One can obtain an undergraduate degree in basic sciences like geology, physics and/or math, and postgraduate degree in geophysics. In India, postgraduate courses in geophysics were started at Andhra University and Banaras Hindu Universities in 1949¹. Even now, most of the geophysics courses in India are postgraduate level but few universities have started integrated course in geophysics for students after intermediate (10+2 level) education. Most of the geophysics courses in India are focused on the exploration geophysics. As it can be seen in the list below the majority of the geophysics programs in India are called either exploration geophysics or applied geophysics, because of the better job opportunities they offer in petroleum industries, mining industries, and ground water related industries.

Indian Universities and their Geophysics Programs

- i. Indian Institute of Technology, Kharagpur (5-years Integrated M.Sc. in Exploration Geophysics, 2 years M.Sc. in Geophysics, and 2-years M.Tech. in Computational Seismology). Web:
<http://www.iitkgp.ac.in/departments/home.php?deptcode=MG>
- ii. Indian Institute of Technology, Roorkee (5-years Integrated M.Tech. in Geophysical Technology, and 3-years M.Tech. in Applied Geophysics). Web:
<http://www.iitr.ac.in/departments/ES/pages/index.html>
- iii. Indian Institute of Technology, Bombay (2-years M.Sc. in Applied Geophysics, 2-years M.Tech. in Geoexploration, and 2-years M.Tech. in Petroleum Geoscience). Web:
<http://www.geos.iitb.ac.in>
- iv. Indian School of Mines University, Dhanbad (5-years Integrated M.Sc. Tech. in Applied Geophysics, and 3-years M.Sc. Tech in Applied Geophysics). Web:
<http://www.ismdhanbad.ac.in/depart/geophysics/index.htm>



- v. Banaras Hindu University, Varanasi (3-years M.Sc. Tech in Exploration Geophysics or Meteorology). Web: <http://www.bhu.ac.in/geophysics/home.html>
- vi. Andhra University, Visakhapatnam (3-years M.Sc. Tech in Geophysics, 2-years M.Sc. in Hydrology, and 2-years M.Sc. in Marine Geophysics). Web: <http://www.andhrauniversity.info/science/geophysics/index.html>
- vii. Osmania University, Hyderabad (2-years M.Sc. in Geophysics). Web: <http://www.osmania.ac.in/Science%20College/Indexpage1.htm>
- viii. Kurukshetra University, Kurukshetra (3-years M.Tech. in Applied Geophysics). Web: <http://kukinfo.com/dept/science/geop/geop.pdf>
- ix. Cochin University of Science and Technology (2-years M.Sc. in Marine Geophysics). Web: http://dept.cusat.ac.in/w_aboutdept.php?deptcode=marinegeo

Job opportunity

Geophysicists are in great demand both in industry and academia. There are various research opportunities in geophysics in both India and abroad. After obtaining a postgraduate degree in geophysics (or in a related science or engineering subjects) one can pursue further research towards PhD and Post-doctoral positions in India and abroad. Most of the Indian universities listed above as well as Indian research centers offer PhD research opportunities in geophysics. Some of the national laboratory actively involved in the development of earth sciences in India are National Geophysical Research Institute (NGRI) at Hyderabad (<http://www.ngri.org.in>), National Institute of Oceanography (NIO) at Goa (<http://www.nio.org>), Centre for Mathematical Modeling and Computer Simulation (C-MMACS) at Bangalore (www.cmmacs.ernet.in), National Environment Engineering Research Institute (NEERI) at Nagpur (www.neeri.res.in), Indian Institute of Geomagnetism (IIGM) at Mumbai (www.iigm.res.in), Indian Institute of Remote Sensing (IIRS) at Dehradun (www.iirs-nrsa.gov.in), National Institute of Ocean Technology (NIOT) at Chennai (<http://www.niot.res.in>), National Centre for Antarctic and Ocean Research (NCAOR) at Goa (www.ncaor.nic.in), Center for Earth Science Studies (CESS) at Thiruvananthapuram (<http://www.cessind.org>), Center for Development of Advanced Computing (CDAC) at Pune (<http://www.cdac.in>), Geological Survey of India (GSI) based in Kolkata (<http://www.gsi.gov.in>), Indian Institute of Science (IISc) at Bangalore (<http://ceas.iisc.ernet.in>), Physical Research

Laboratory (PRL) at Ahmedabad (<http://www.prl.res.in>), Wadia Institute of Himalayan Geology (WIHG) at Dehradun (www.wihg.res.in), Naval Physical Oceanographic Laboratory (NPOL) at Kochi (www.drdo.com/labs/npol/historical_background.html), and Bhabha Atomic Research Centre (BARC) at Mumbai (www.barc.ernet.in). Govt. of India provides research assistantships for PhD research. There are opportunities to get permanent scientist position in those research centers and faculty position in universities. There are also many universities and research centers around the world who always look for intelligent and motivated students/scholars.

Some of the industries that are keen in employing geophysics students include: petroleum industries, various mining industries, ground-water based industries, and cement industries. The job types can vary from field based to an office location working mostly with computers to analyze data. Recently there has been a great demand for geophysics students in petroleum industries and the opportunities are very lucrative. In India there are both government (public sector units) and private petroleum companies. Government petroleum companies are: Oil and Natural Gas Corporation Limited (ONGC) based in Dehradun (<http://www.ongcindia.com>), Oil India Limited (OIL) based in Duliajan (<http://www.oil-india.com>), and Gujarat State Petroleum Corporation Limited (GSPC) (<http://www.gujaratpetro.com>). There are many domestic and international private petroleum companies currently operating in India such as Reliance Industries Limited (RIL) based in Mumbai (<http://www.ril.com>), Shell India Limited based in Bangalore (<http://www.shell.com>), Essar based in Mumbai (<http://www.essar.com/oil&gas.htm>), Cairn India based in Gurgaon (<http://www.cairnindia.com>), Hardy Exploration and Production (India) Inc based in Chennai (<http://www.hardyoil.com/assets.htm>), Selan Exploration Technology Limited based in Gurgaon (<http://www.selanexploration.com>), and Jubilant Enpro Limited based in Noida (<http://www.jubilantenpro.com>). Petroleum based domestic and international service companies in India are also interested in geophysics students, some of these companies are: Schlumberger (<http://www.slb.com>), WesternGeco (<http://www.westerngeco.com>), Halliburton (<http://www.halliburton.com>), Fugro (<http://www.fugro.in>), Fugro-Jason (<http://www.fugro-jason.com>), CGGVeritas (<http://www.cggveritas.com>), and Petroleum Geo-Services (PGS) (<http://www.pgs.com>).

Geophysical society

Professional societies provide a platform to share, interact and discuss technology and challenges. Three geophysical societies in India are: Society of Petroleum Geophysicist (SPG) based in Dehradun



(www.spgindia.org), Association of Exploration Geophysicists (AEG) based in Hyderabad (<http://www.aegindia.org>), and Indian Geophysical Union based in Hyderabad (<http://www.igu.in>). These societies are always interested in helping students in education, research collaboration, providing resources (data, books and software), financial support (scholarships and travel grants to attend conferences) and even job opportunities. SPG has local chapters in various cities and universities in India for better and frequent interactions. SPG has also an international chapter operating from USA, which is called the North American Chapter (<http://www.spgnorthamerica.org>). It includes Indian origin geophysicists from North America (USA and Canada) as well as Indian geophysicists based in other foreign countries. There are many international geophysical societies that provide a global platform, and they promote geophysics education/research and help geophysics students from worldwide universities. Some of these international societies are: Society of Exploration Geophysicists (SEG) based in Tulsa, USA (<http://www.seg.org>), European Association of Geoscientists and Engineers (EAGE) based in the Netherlands (<http://www.eage.org>), and American Geophysical Union (AGU) based in Washington DC, USA (<http://www.agu.org>). Every geophysical society conducts annual or biannual conferences and many other workshops and symposiums. For example, SEG, EAGE, and AGU conduct annual conference; SPG and Petrotech (<http://www.petrotechsociety.org>) organize conferences in alternate years (complimentary to each other) in the month of January. Petrotech organized its 8th conference in New Delhi in January 2009 and SPG plans to have their 8th biannual conference in Hyderabad during 18-20 January 2010. Students are very welcome to these society meetings; there are several programmes organized especially for students. So, keep an eye on these meetings and plan/apply in advance to attend these conferences as you might receive various advantages over others including financial support. Students can also submit abstract based on present research to present during the conference and that will help them get recognized by professional geophysicists, find a job, and get research assistantships for further research.

Summary

Geophysics is an applied science that uses many science and engineering subjects to study earth related problems. There are nine universities in India providing postgraduate education in geophysics. Most are focused on exploration geophysics that prepares students for job opportunities in petroleum, ground water, cement, and mining industries. Exploration geophysics is an integrated science that is very interesting and provides great job opportunities. However, solid earth geophysics is

also very important as it studies global earth system and there is a need to emphasize this in Indian education and research. Professional societies in India and abroad are great resources for students to network, learn from experienced geophysicists, collaborate on research projects and are even useful to find jobs. I personally recommend high school, intermediate school, and undergraduate students to consider geophysics as a subject in future studies. Also, I strongly recommend present geophysics students and professional geophysicists to consider getting associated with geophysical societies in India and abroad.

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