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The following technical talks were organized for the benefits of U.G and Faculty members of the department for the even semester 2015.

Sl. No	Date	Title of the technical talk	Name of Invited speaker
1	18-08-2015	Characterization of Metals using XRD/SEM	**Dr. Jagannath Nayak** Professor & Head, Dept.of Metallurgical & Materials Engineering, NITK Surathkal
2	12-09-2015	Materials and Issues in Thermal Power Plants - CPRI Experiences	**Mr. M.G Anand kumar** Engineering Officer, The Materials Technology Division, Central Power Research Institute, Bengaluru
3	22-09-2015	Vegetable oils for Green Manufacturing	**Dr. Shashidhar Y M** Professor, Dept.of Automobile Engg, Malnad College of Engg, Hassan
4	01-09-2015	Corrosion and its control	**Dr. Achuta Kini** Professor, MIT, Manipal
5	15-09-2015	Lost wax casting process in Dentistry	**Dr. Ravindra Kotian** HOD, Department of Dental Materials, Manipal College Of Dental Sciences, Mangalore, Manipal University

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Materials Characterization by Scanning Electron Microscopy

Dr. Jagannath Nayak
Professor and Head, Dept. of Metallurgical and Materials Engg,
National Institute of Technology Karanataka, Surathkal

Talk by **Dr. Jagannath Nayak**

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Talk by **Dr. Jagannath Nayak**

A technical talk on the topic "***Materials Characterization by Scanning Electron Microscopy***" was delivered by ***Dr. Jagannath Nayak,*** Professor and Head, Dept. of Metallurgical and Materials Engg, NITK Surathkal on 18th August 2015.

He said, *Scanning Electron Microscopy* (SEM) is a powerful technique in the examination of materials. It is used widely in *metallurgy, geology, biology, medicine* and even in many fields. He also explained about the working principle of SEM which operates at a high vacuum. The basic principle is that a beam of electrons is generated by a tungsten filament or a field emission gun is accelerated through a high voltage and pass through a system of apertures and electromagnetic lenses to produce a thin beam of electrons. The beam scans the surface of the specimen by means of scan coils.

Electrons are emitted from the specimen by the action of the scanning beam and collected by a suitably-positioned detector. Then image can be seen on a screen.

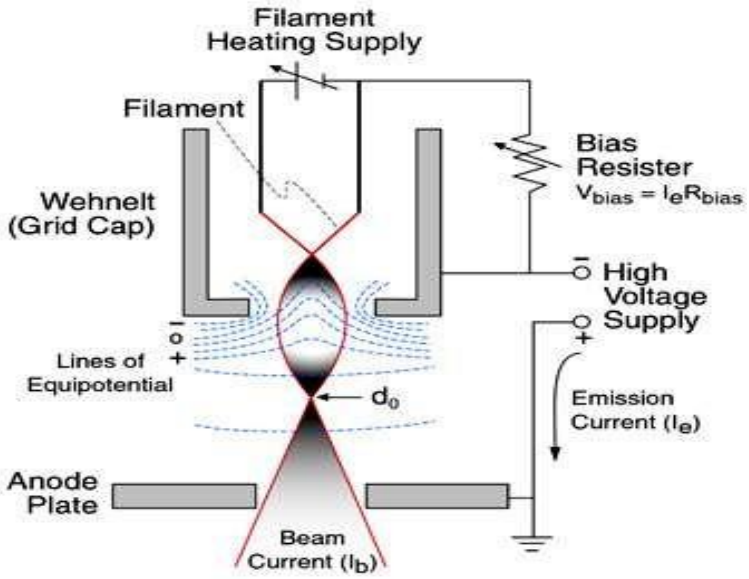
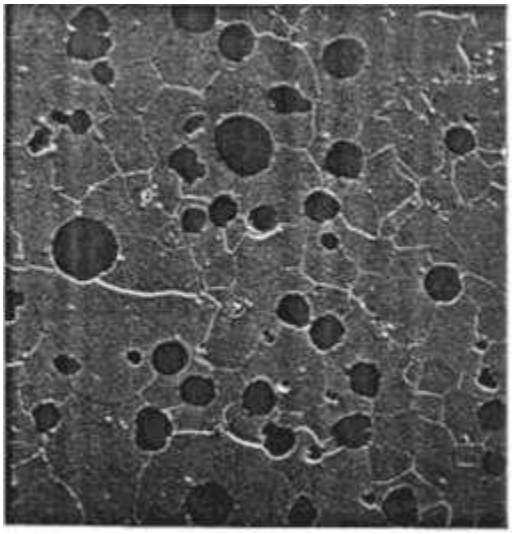


Fig : Working principle of SEM

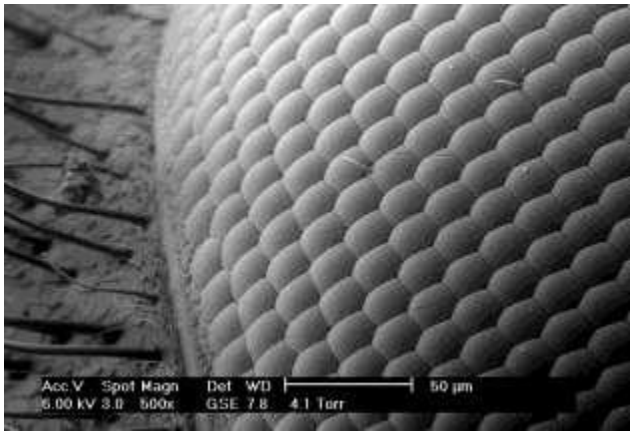
Fig: SEM facility at NITK Surathkal

Magnification in a SEM can be controlled over a range of up to 6 orders of magnitude from about 10 to 500,000 times. Some types of detectors used in SEM have analytical capabilities, and can provide several items of data at each pixel. Examples are the Energy-dispersive X-ray spectroscopy (EDS) detectors used in elemental analysis and Cathodo luminescence microscope (CL) systems that analyse the intensity and spectrum of electron-induced luminescence in (for example) geological specimens.

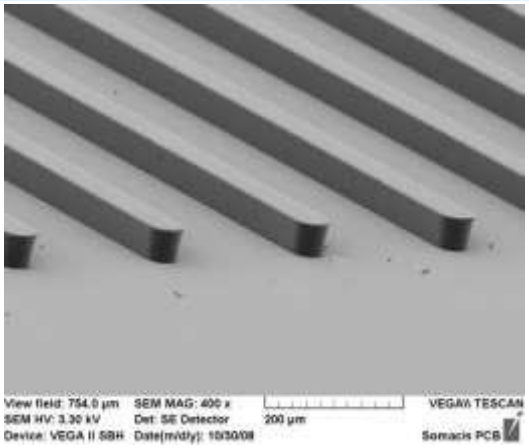
In his presentation he showed some specific SEM images which were captured by researchers at NITK Surathkal. Few of them are wings of butter fly, eye of an insect, Ductile fracture showing dimples, copper tracks on printed circuit board, and steel representing the formation of martensite etc.



A. SG Iron

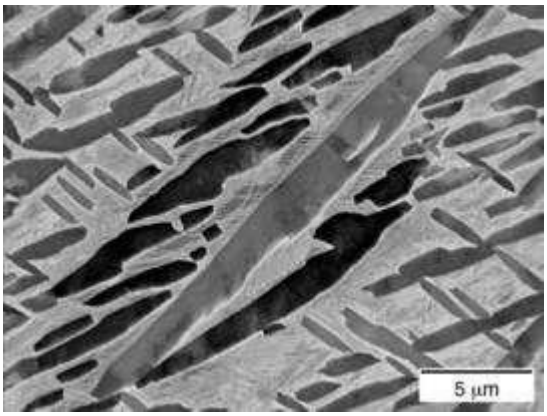


B. Eye of an insect

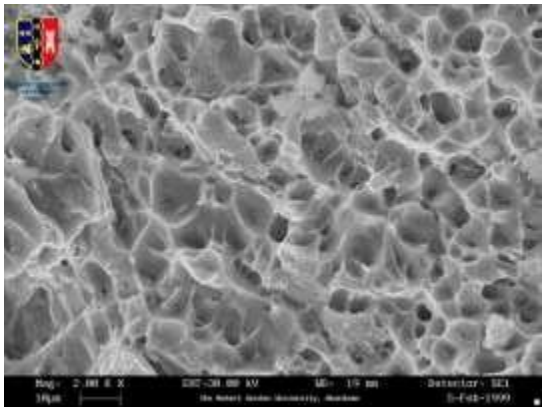


C. Copper tracks in SEM

D. Fe-1%C steel



E. Alpha laths in a matrix of martensite



F. Ductile fracture showing dimples

The main benefits of this talk are students (U.G and P.G sections) and faculty members of the department got exposure to understanding the use of SEM and characterisation of materials using the same. The talk was specially appreciated by faculty members who have registered for Ph.D course since the talk was specific to their subject. In conclusion the talk was benefited for U.G, P.G and faculty members of the department.

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Materials and Issues in Thermal Power Plants - CPRI Experiences

Mr. M.G Anand Kumar
Engineering Officer, The Materials Technology Division
Central Power Research Institute, Bengaluru

Talk by **Mr. M.G Anand Kumar**

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Talk by **Mr. M.G Anand Kumar**

A technical talk on the topic "***Materials and Issues in Thermal Power Plants - CPRI Experiences***" was delivered by ***Mr. M.G Anand Kumar,*** Engineering Officer, The Materials Technology Division Central Power Research Institute, Bengaluru on 12th September 2015.

Initially, a video related to the profile of Central Power Research Institute (CPRI) was presented. He said, CPRI has a vast experience and expertise in the areas of material characterization, simulation, diagnostic, calibration, and system analysis. CPRI also provides the consultancy services on various needs of power sector besides offering Customised Training Programmes. It has been extending its services for over five decades to industries in their quest for innovation, new product development, import substitution, quality assurance etc.

In his presentation, emphasis on Coal Analysis and Testing Laboratory was highlighted. He said, coal based power generation accounts for over 83% of India's

thermal power capacity. There is about 20% short fall of domestic coal supply in the country based on the forecast made by Coal India Ltd for the next 5 years. It was also expressed that, the imported coal is being blended with Indian coals and fired in the thermal power plants. There are crucial issues involved in respect of firing blended coals in existing Indian thermal power plants, as the boilers are designed for Indian coal characteristics.

Peat coal *Lignite coal* *Sub – bituminous coal*

bituminous coal Anthracite

Types of coals available in India

He said, some of the properties like thermal input and overall ash loading can be predicted from the blend ratio of the constituent coals, but not all the other properties. Some of the qualitative properties like grindability, ash fusion temperature, combustion reactivity, etc are generally non additive. This leads to unexpected problems like reduced mill efficiency, clinker formation, increased

unburnts in ash, etc. In this context, fixing blend proportion based only on ash load and heat value is questionable.

Then, the talk was directed towards RLA (Remaining life assessment) methodology and types of tests carried out during RLA. *Remaining life assessment* is an estimate of the reliability of a product in its life cycle application environment based on health monitoring and prognostics analyses. The purposes of RLA Technology are Escalating cost of new units, Extended lead times in plant construction, Increasingly stringent environment and safety regulations, Increasing awareness of the technological feasibility of extending component life, Metallurgical damage through thermally induced, degradation, Service sponsored damage (creep, thermal fatigue, fatigue), Mechanical damages (Fly ash erosion), Metal Oxidation / Corrosion, Chemical damage due to disturbance in feed water quality, Operation outside design limits.

He said, there are three methods of RLA,

Level – 1 : Operational history

Review of historical problems

Level – II : Detailed Inspection Plan

Identification of critical components

Analysis of root cause of problems

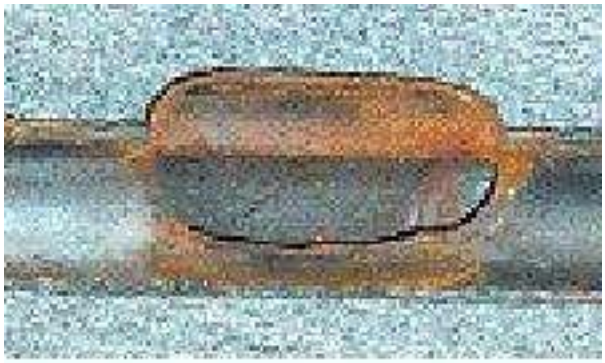
Level – III : Non-destructive Examination

Header –T
Weld inspection

Steam pipe

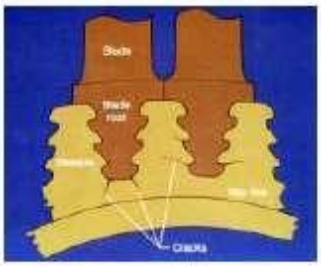
Creep fatigue

Main steam pipe weld failure



Hydrogen embrittlement

Fig : Typical boiler component inspection for RLA study



Turbine Blade steeple

Turbine Casing

Turbine Bolt

Fig : Inspection of turbine components for RLA study

He talked on Assessment of Microstructural Degradation in which the following tests/methods to be followed

Laboratory Evaluation - Destructive in nature
Sampling of tubing required
Limitations – sampling

In-Situ Metallography - No Sampling Is Required
On Site Assessment By Replication
Technique

Result stages of graphitiztion
inspection interval strategies
qualitative assessment

In his presentation he said, oxide scale in boiler tube produced by oxidation of tube metal, (steam side - tube internal), Compound of Complex iron oxides. Due to oxidation , Reduces heat transfer, Increases tube metal temperature, Increases the rate of scale formation, Reduces the effective wall thickness, and hence the operating stress, Promote creep in tube metal

Oxide layer formation in the boiler tube

He spoke on Methodology for Oxide Scale Measurements

Conventional : Destructive Technique,
Lab. Evaluation of samples cut and
removed from component by Optical or Scanning
Electron Microscopy

Advanced : Non - Destructive Evaluation,
Ultrasonic technique using high frequency,
special long delay line probes

In concluded that, Comprehensive evaluation of Remaining life of tubes taking into account of fire side corrosion and metallurgical degradation Advanced NDE methods viz. UT using EMATs, Phased array UT for turbine components, Small punch tests for embrittlement studies etc are required.

The main benefits of this talk are students (U.G and P.G sections) and faculty members of the department got exposure to understanding concept of coal analysis and their characterisation. The talk was specially appreciated by faculty members who have registered for Ph.D course (both thermal and materials background) since the talk was specific to their subject. In conclusion the talk was benefited for U.G, P.G and faculty members of the department.

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Vegetable oils for Green Manufacturing

Dr. Y M Shashidhara
Professor
Dept. of Automobile Engineering
Malnad College of Engineering, Hassan

Talk by Prof. Y M Shashidhara

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Memento to Prof. Y M Shashidhara by Prof. K V Suresh, HOD Mech

A technical talk on the topic '***Vegetable oils for Green Manufacturing'*** was delivered by ***Dr. Y M Shashidhara,*** *Professor, Dept. of Automobile Engineering Malnad College of Engineering, Hassan*, on 22th September 2015.

He said, vegetable oils are increasingly used as a substitute for fossil fuels. Vegetable oils are the basis of biodiesel, which can be used like conventional diesel. Some vegetable oil blends are used in unmodified vehicles, but straight vegetable oil needs specially prepared vehicles which have a method of heating the oil to reduce its viscosity and surface tension. Another alternative is vegetable oil refining. Applications of vegetable oils are Agricultural equipments, Automotive Engines, Hydraulic Machines, Food industry, Cement industry, Manufacturing industry, Metal cutting and metal forming.

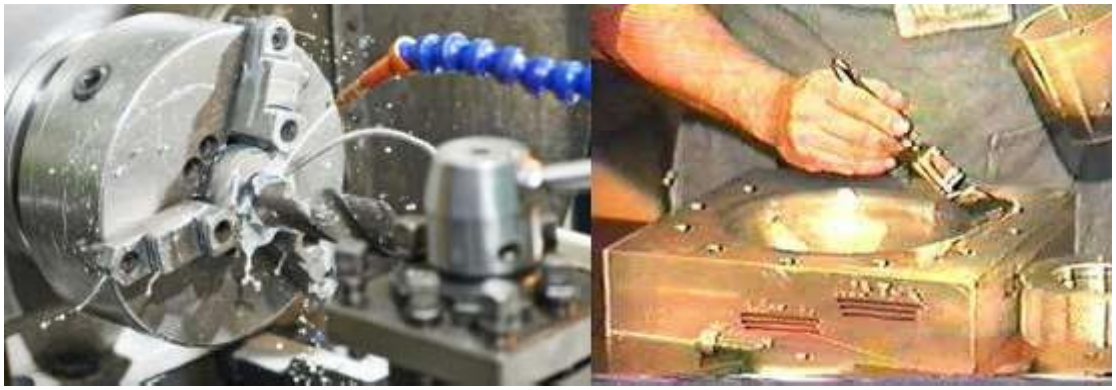

Fig: Applications of vegetable oils

He spoke on future of energy for world economy. He said, along with straight vegetable oil and biodiesel, some energy technologies that could play an important part in the future include those are : hydrogen economy, methanol fuel, ethanol fuel, lithium economy, zinc-air battery, liquid nitrogen economy, synthetic fuel, solar energy / photovoltaics, nuclear power (fission power), fusion power, wind power compressed air energy storage, flywheel energy storage and biofuel

Fig: Type of vegetable oils

Then the talk was directed to use of vegetable oil for transportation. He said there are four different ways in which vegetables can be used in transportation sector. **Vegetable oil blends** - Mixing vegetable oil with diesel where users get some of the advantages of burning vegetable oil and is often done with no modification to the vehicle. **Biodiesel** - If vegetable oil is transesterified it becomes biodiesel. Biodiesel burns like normal diesel and works fine in any diesel engine. The name just indicates that the fuel came from vegetable oil. **Straight vegetable oil** - Straight vegetable oil works in diesel engines if it is heated first. **Vegetable oil refining** - Vegetable oil can be used as feedstock for an oil refinery. Some diesel engines already heat their fuel; others need a small electric heater on the fuel line. How well it works depends on the heating system, the engine, the type of vegetable oil (thinner is easier), and the climate (warmer is easier). There it can be transformed into fuel by hydrocracking (which breaks big molecules into smaller ones using hydrogen) or hydrogenation (which adds hydrogen to molecules). These methods can produce gasoline, diesel, or propane. Some commercial examples of vegetable oil refining are NExBTL, H-Bio, and the ConocoPhilips Process.

He said, the availability of biodiesel around the World is increasing. It is estimated that by 2010 the market for biodiesel will be 7.5 billion litres (2 billion USgallons) in the U.S and 9.5 billion litres (2.5 billion USgallons) in Europe. Biodiesel currently has 3% of the diesel market in Germany and is the number 1 alternative fuel. The German government has a Biofuels Roadmap in which they expect to reach 10% biofuels by 2010 with the diesel 10% coming from fuel made from vegetable oil. From 2005 to 2007 a number of types of vegetable oil have doubled in price. The rise in vegetable oil prices is largely attributed to biofuel demand.
He said, to select a Vegetable oil the following points to be considred, High viscosity index, High lubricity, High flash point, Low evaporative loss, High biodegradability and Low toxic.

Finally the talk was directed towards environmental effects of vegetable oils. He said, there is concern that the current growing demand for vegetable oil is causing deforestation, with old forests being replaced with oil palms. When land is cleared it is often burned, which releases lots of CO_2. Vegetable oil production would have to increase substantially to replace gasoline and diesel. With current technology such an increase in production would have a substantial environmental impact.

The main benefits of this talk is students (U.G and P.G sections) and faculty members of the department got exposure to understanding concept of use of vegetable oil as biodiesel. The talk was specially appreciated by faculty members who have registered for Ph.D course (thermal background) since the talk was specific to their subject. In conclusion the talk was benefited for U.G, P.G and faculty members of the department.

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Corrosion and Corrosion control

Dr. U Achutha Kini
Professor
Dept. of Mechanical & Manufacturing Engg, MIT Manipal

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Talk by Dr. U Achutha Kini

A technical talk on the topic '***Corrosion and Corrosion control'*** was delivered by ***Dr. U Achutha Kini, Professor, Dept. of Mechanical & Manufacturing Engg, MIT Manipal*** on 1st October 2015.

He said, Corrosion is the deterioration of materials by chemical interaction with their environment. The term corrosion is sometimes also applied to the degradation of plastics, concrete and wood, but generally refers to metals. The most widely used metal is iron (usually as steel).

Then he focused on the consequences of corrosion. He said, the consequences of corrosion are many and varied and the effects of these on the safe, reliable and efficient operation of equipment or structures are often more serious than the simple loss of a mass of metal. Failures of various kinds and the need for

expensive replacements may occur even though the amount of metal destroyed is quite small. Some of the major harmful effects of corrosion can be summarised are 1. *Reduction of metal thickness* leading to loss of mechanical strength and structural failure or breakdown. 2. *Hazards or injuries to people arising from structural failure or breakdown* (e.g. bridges, cars, aircraft). 3. *Loss of time in availability of profile-making industrial equipment*. 4. *Reduced value of goods due to deterioration of appearance*. 5. *Contamination of fluids in vessels and pipes* (e.g. beer goes cloudy when small quantities of heavy metals are released by corrosion). 6. *Mechanical damage to valves, pumps, etc*, or blockage of pipes by solid corrosion products and many more.

Dr. Kini expressed that the following statements are generally accepted as facts for corrosive environments. Moist air is more corrosive than dry air, Hot air is more corrosive than cold air, Hot water is more corrosive than cold water, Polluted air is more corrosive than clean air, Acids are more corrosive than bases (alkalis) to steels, Salt water is more corrosive than fresh water, Stainless steel has very high corrosion resistance than ordinary steel, No corrosion will occur in a vacuum, even at very high temperatures.

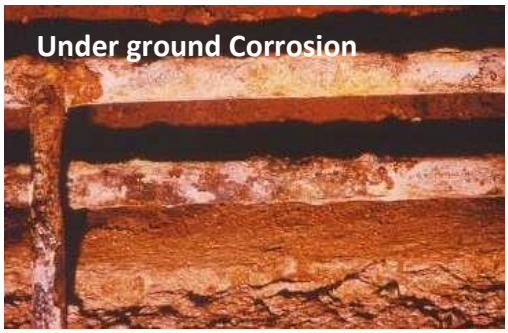

Fig: Examples of corrosion

Then the talk was directed towards, the factors influencing corrosion rate ***Nature of metal***: Metals with higher electrode potentials do not corrode easily. ***Ratio of cathodic to anodic area***: The rate of corrosion is influenced by relative size of cathodic to anodic areas. If the metal has small anode and large cathodic region, corrosion rate is very high. ***Nature of corrosion product:*** The corrosion product formed like metal oxide may act as protective film, if it is stable, insoluble, and non porous **pH of the medium** : In general, rate of corrosion is higher in acidic pH than in neutral and alkaline pH. **Temperature :** Corrosion rate increases with increase in temperature **Effect of oxygen**: Oxygen acts as an important corroding medium. If the metal is exposed to different concentration of oxygen, differential aeration corrosion takes place. **Surface Roughness**: The surface finish of the component also has an impact on the mode and severity of the corrosion that can occur. **Time**: Corrosion rates are expressed using a time dimension only (generally per year).

Dr. Kini said there are different types of corrosion Uniform Corrosion, Bimetallic Corrosion, Pitting Corrosion, Crevice Corrosion, Filiform Corrosion, Intergranular Corrosion, Stress Corrosion Cracking, Corrosion Fatigue, Fretting Corrosion, Dealloying/Selective Leaching, Corrosion in Concrete, Microbial Corrosion. Then, finally the talk was directed to Controlling of corrosion.

Selection of metal and alloy, Proper design of metal, Cathodic Protection, Sacrificial anodic protection Method, Impressed current method, Modifying Environment, Eliminating dissolved oxygen, Reducing Moisture, Reducing Acidity, Protective coating, Metallic coatings, Chemical conversion Coatings and the Use of corrosion Inhibitors.

The talk was specially appreciated by senior faculty members since the talk was specific to their research. In conclusion the talk was benefited for U.G, P.G and faculty members of the department.

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Lost wax casting process in Dentistry

Dr. Ravindra Kotian
HOD, Department of Dental Materials,
Manipal College Of Dental Sciences, Mangalore,
Manipal University

Talk by **Dr. Ravindra Kotian**

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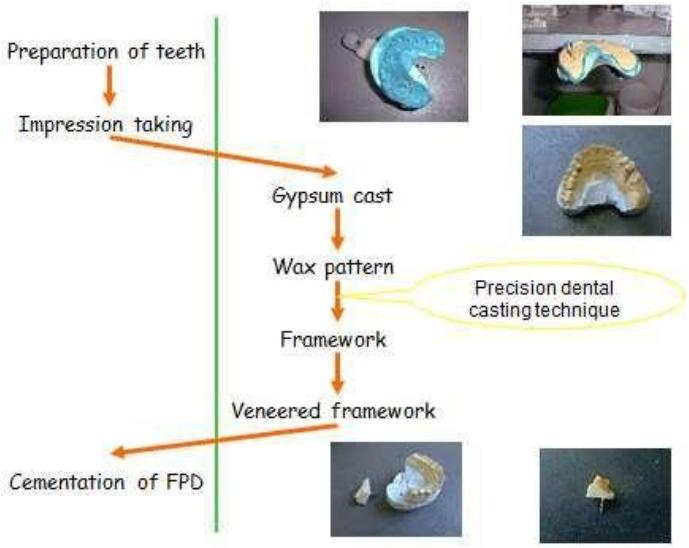
Memento to **Dr. Ravindra Kotian** by **Prof. Ravinrdan**

A technical talk on the topic "***Lost wax casting process in Dentistry***" was delivered by ***Dr. Ravindra Kotian,*** HOD, Department of Dental Materials, Manipal College of Dental Sciences, Mangalore, Manipal University on 13th October 2015 at 3.15pm in the main seminar hall.

He said, Lost-wax technique is so named because the wax pattern invested in a ceramic material is burned out ("lost") to create a space into which molten metal is cast. He focussed on use of lost wax in Dental applications.

Fig : Dental applications

Dr. Ravindra Kotian explained preparation of teeth using above said technique.



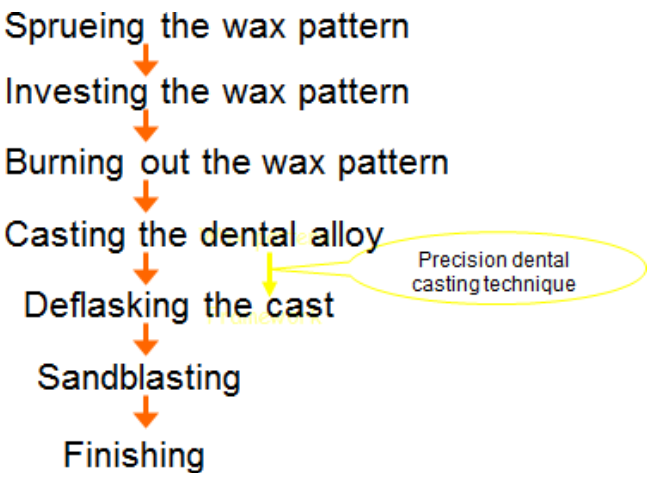


Fig: Procedure for preparing the teeth

He said, the casting technique involve, melting the alloy in induction furnace and casting the alloy in vaccum or centrifugal casting. In the talk he said, the following defects may occur, porosity inclusions (foreign particles) in castings, and rough castings,

Pattern is due to improperly sprued. Sprues may be too thin, too long or not attached in the proper location, causing shrinkage porosity. It occurs due to Not enough metal reservoir to eliminate shrinkage porosity.

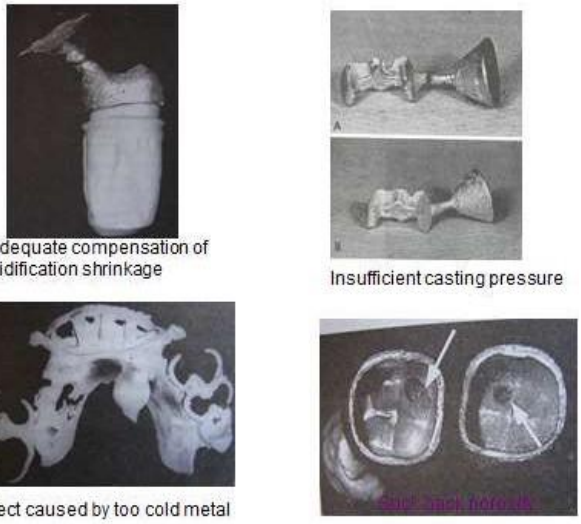


Fig: Reasons for casting defects

Fig: Reasons for casting defects

Fig: Finishing the framework

During conclusion he said, mechanical engineering is a vast field in which students should focus on developing innovative materials related to dental, aerospace, medical application etc. not only restricted to specific area like robotics, thermal fluid mechanics, design etc.

The main benefits of this talk are, students and faculty members of the department got exposure to understanding the importance of

Lost wax casting in dental materials.