



**AVIT**  
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY



VINAYAKA MISSION'S  
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**DEPARTMENT OF MECHANICAL ENGINEERING**  
**INDIAN INSTITUTE OF METALS (IIM) –KALPAKKAM CHAPTER**  
**Report – Webinar on “Ion Beams and Nanomaterials”**

**21<sup>st</sup> December 2020**

**Resource person: Dr.B.Sundaravel**

Scientific Officer –G & Associate Professor,  
HBNI Materials Science Group,  
IGCAR, Kalpakkam.

**Participants: 83**

Department of Mechanical Engineering in association with Indian institute of metals (IIM) Kalpakkam chapter organised a Webinar on the topic “**Ion Beams and Nanomaterials** ” on **21<sup>st</sup> December 2020**.

**The topics covered in Webinar**

- Ion Beam Accelerator Facilities at IGCAR
- Ion beams usage in Material synthesis.
- Ion beams used in modification of properties.
- Characterization of Materials
- Radiation Damage
- Synthesis and modification of Nanomaterials.

**Webinar Outcome**


- Students understood the importance and different types of Ion beams and nanomaterials.
- Production of Energetic Ions using Accelerators.
- Accelerator based Material research.
- Accelerators facilities at Material science group IGCAR
- Ion beam analysis.
- Synthesis of nanomaterials using energetic ions.
- Different types of carbon nanomaterials.
- Radiation enhanced diffusion and segregation.

The Webinar was coordinated by Dr.D.Bubeshkumar, Associate professor and Mr.A.Senthilkumar, Assistant Professor (Gr-II).Prof L.Prabhu VP (Administration) and HOD Mechanical department given the presidential address. The chief guest introduction was given by Mr.A.Elanthiraiyan, Assistant Professor Grade-II department of mechanical engineering.

REC

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Zoom 00:17 Leave



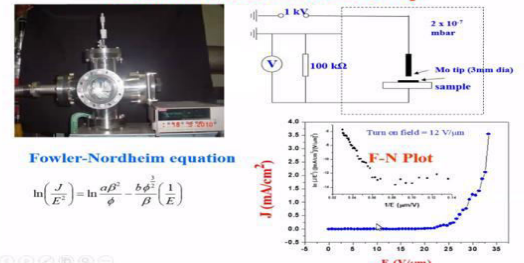
**200kV Accelerator at UGC-DAE-CSR, Kalpakkam Node**

Tested On Target  
 200 keV ions  
 Ar<sup>+</sup> 130 μA  
 Au<sup>+</sup> 64 μA  
 B<sup>+</sup> 70 μA  
 H<sup>+</sup> 1 μA  
 Xe<sup>+</sup> 100 μA  
 N<sup>+</sup> 100 μA

Energies  
 20keV to 200keV

For University students.  
 Funding 15 to 20 Research projects per year.

**Electron Field Emission Set up**



**Fowler-Nordheim equation**

$$\ln\left(\frac{J}{E^2}\right) = \ln\left(\frac{\sigma\beta^2}{\phi}\right) - \frac{b\phi^2}{\beta} \left(\frac{1}{E}\right)$$

**F-N Plot**

Turn on field = 12 V/μm

2 x 10<sup>-7</sup> mbar

Mo tip (5mm dia) sample

1 kV, 100 kΩ, V

J (mA/cm<sup>2</sup>) vs E (V/μm)

Unmute
Start Video
Share Screen
Participants
More

Sundaravel B's screen

3:10 PM 12.6KB/s

Participants (83)

Search

- RK **Rahul Kumar 3441910529** (me)
- A **A.Senthilkumar** (Host)
- SB **Sundaravel B** (Co-host)
- B **bubeshkumarmech@g...** (Co-host)
- EA **Elanthiraiyan A** (Co-host)
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- 3A **3441955528 Ammar Ahmed Pasha**
- A **A.Imthiyas**
- AC **Abin Chacko Varghese (3441710501)**
- AJ **Aby Jose 3441955507**

Invite

## Accelerator based Materials Research

### Ion implantation

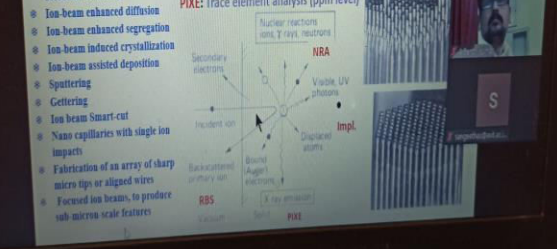
- Doping of Semiconductors
- Synthesis of embedded nanoparticles
- Ion beam synthesis
- Highly non-equilibrium states
- Ion beam Mixing
- Surface Modification
- Improvement of hardness and corrosion resistance
- Ion-beam enhanced diffusion
- Ion-beam enhanced segregation
- Ion-beam induced crystallization
- Ion-beam assisted deposition
- Sputtering
- Gettering
- Ion beam Smart-cut
- Nano capillaries with single ion impacts
- Fabrication of an array of sharp micro tips or aligned wires
- Focused ion beams, to produce sub-micron scale features

### Ion beam Analysis

- RBS: Composition, concentration, thickness of thin film
- ERDA: light element concentration depth profile
- Channeling: Crystalline quality, Lattice location in single crystals
- NRA: Depth profiling of low Z elements
- PIXE: Trace element analysis (ppm level)

### Radiation Damage

- Production of defects
- Void swelling
- Burn-up of fuel



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