

# Seminar

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## Institute for Plasma Research

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**Title :** Next Generation Optoelectronics through Plasma Nanotechnology

**Speaker :** Dr. Amreen Ara Hussain  
Indian Institute of Technology Indore

**Date :** 16th March 2018 (Friday)

**Time :** 03.30 PM

**Venue :** Committee Room 3, (New Building), IPR

### **Abstract :**

Optoelectronics is at the crossroads of electronics and optics. The field of optoelectronics have been revolutionized by use of nanotechnology at recent time. In the meantime, plasma nanotechnology which addresses the technological development for the synthesis of nanomaterials, also emerges as a potential source in optoelectronics due to its advantage of being a completely dry and green process [1,2]. This presentation will be emphasized on combining optoelectronic devices/circuitry through plasma nanotechnology. Initially the market and R&D status of optoelectronics at global level will be discussed briefly followed by highlighting the recent developments in organic and inorganic photodetectors. Additionally, some experimental prospects of optoelectronic devices realized using plasma nanotechnology will be discussed and compared.

In the field of optoelectronics, we have specifically highlight the fabrication of various geometries of hybrid photodetectors by plasma based processes. First systematic efforts have been devoted in designing various organic-inorganic nanocomposites which can be directly integrated in the optoelectronic circuitry. We have synthesized both binary and ternary nanocomposites with polymer, small molecule and metal oxides. We have also studied the interesting photophysical phenomena associated with the as-prepared nanocomposite materials. Second, we have fabricated hybrid photodetectors using the as-prepared nanocomposites and studied the photoresponse. We address the various strategies to overcome bottleneck in getting a balance in photoconductive gain and response speed trade-off of the hybrid photodetectors. In parallel, systematic efforts have been devoted in understanding the underlying photo-physics and device physics in such systems.

Finally, based on the findings, we may conclude that plasma based method provides a green and dry technology where the self-assembly of molecules, under plasma environment, emerge as a successful strategy to form well-defined structural and morphological units of nanometre dimensions that can be directly integrated in the fabrication of exceptionally stable optoelectronic devices.

### References:

- [1] Hussain, A. A., Pal, A. R. & Patil, D. S. Appl. Phys. Lett. 104, 193301 (2014).
  - [2] Hussain, A. A. & Pal, A. R. J. Mater. Chem. C 5, 1136 (2017).
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