

# Seminar

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## Institute for Plasma Research

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**Title :** Nanoparticle synthesis by thermal plasma in liquid and gaseous medium

**Speaker :** Dr. Arkaprava Das  
FCIPT, IPR, Gandhinagar

**Date :** 11<sup>th</sup> June , 2020 (Thursday)

**Time :** 03:30 PM

**Venue :** Online- Join the talk:

<https://meet.ipr.res.in/PDFtalk-Arkaprava>

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### Abstract:

A high temperature arc plasma route synthesis of zinc oxide nanoparticle in water as well as in air medium will be presented. Structural analysis reveals the presence of Zn metal in water whereas air ambient synthesized nanoparticles are existing only in wurtzite hexagonal ZnO phase. In water, after emerging out from the plume, atoms starts to cool down immediately and due to unavailability of free oxygen atoms, some unreacted Zn atoms form a separate hexagonal metallic Zn phase. Scanning electron microscopy (SEM) manifests higher crystallinity and rod like structure for pure ZnO nanoparticles in air medium but on the other hand water medium synthesized nanoparticles show spherical nature with low crystallinity and changed morphology. The oxygen vacancies/interstitial or Zn vacancies/interstitial might be the probable reason for modified morphology and the study of which is in our future plan.

Apart from ZnO nanoparticle synthesis, we have also synthesized cobalt oxide, Iron oxide nanoparticle in helium (He), air ambient under different arc currents and studied its structural, microscopic and electronic properties. X-ray diffraction (XRD) and X-ray absorption spectroscopy (XAS) analysis reflects the presence metallic Co and Fe phase in He medium due to lesser oxygen partial pressure in the synthesis ambience. Due to higher quenching tendency of He gas, a smaller particle size as well as size distribution as observed from TEM images. Metallic Fe and Co phase fraction is the maximum at higher arc current and results in a core shell type structure with oxide layered surface passivation. Due to this, M-H loops manifests a fluctuating value of coercivity with varying arc current in He ambience.

These well correlated outcomes exhibit in-depth information regarding different phase formation and its impact upon different physical properties which can be anticipated as significantly handy not only in controlling the versatile properties of nanoparticles but also for the blooming of plasma based synthesis technology.

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