Seminar

Institute for Plasma Research

Title : Thermal plasma synthesis of magnetic nanoparticles - Study of process parameters influencing the nanostructure and magnetism

Speaker: Dr. Prachi Orpe
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Date : 22nd October 2021 (Friday)

Time : 03.30 PM

Venue : Online - Join the talk:
https://meet.ipr.res.in/Dr.PrachiOrpe_PDFTalk

Abstract :

The gas phase synthesis route for production of nanopowders has proven effective as compared to mechanical or chemical routes [1]. The high temperature processing method such as thermal plasma is versatile and attractive due to high purity products, ease of synthesizing and higher yield of nanopowders [2-4].

It has been observed that physical and chemical properties of bulk materials differ as it reaches nanoscale sizes viz. 1-100 nm and this change in properties also depend on the process parameters of the thermal plasma. In this process, the high heat generated results in evaporation of the target material. The atomic flux coming out of plasma zone leads to homogenous nucleation and growth of clusters in gas phase itself. The high temperature gradient and reaction rates results in some interesting properties of nanoparticles.

In the talk I will be focusing on the results obtained from synthesis and study of cobalt based nanostructures by thermal arc plasma process. Among the various parameters, two process parameters (i) arc current (ii) gas ambience (He/air and He) were varied and studied for its influence on the formed nanoparticles. Techniques like TEM, XRD, VSM etc. were used to analyse the nanostructures and the influence of these process parameters on the morphology, crystal structure, composition and consequently on the final magnetic properties. The study clearly brings out the influence of arc current on the morphological features like shape, size etc. On the other hand, the gas ambience variation studies bring out its influence on the oxidation state, reactivity of metallic cobalt etc. Both these parameters have been found to affect the magnetic properties to a larger extent. These results will be presented and discussed in the talk.

References

[1] Olayinka Oluwatosin Abegunde, Esther Titilayo Akinlabi, Oluseyi Philip Oladijo, Stephan Akinlabi, Albert Uchenna Ude, *AIMS Material Science*,**6**, (2019) 174.

[2] Haining Meng, Fangxia Zhao, Zhenzhong Zhang, *Int. J. Refractory Metals and Hard Mater.*,**31**, (2012) 224.

[3] Ruslan Sergiienko, Etsuro Shibata, Akase Zhentaro, Daisuke Shindo, Takashi Nakamura, Gaowu Qin, *Acta Mater.*,**55**, (2007) 3671.

[4] C Balasubramanian, B Joseph, P B Orpe, NL Saini, S Mukherjee, K Dziedzic- Kocurek, J Stanek, D Di Gioacchino, A Marcelli, *Nanotechnology*,**27**, (2016) 445701.