Seminar

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Institute for Plasma Research

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Title: Synthesis, Structural and Microstructural study of Al_2O_3 composite for application in Nuclear reactors

Speaker: Dr. Asha Panghal
ITER-India, IPR

Date: 13th July 2023 (Thursday)

Time: 11:00 aM

Venue: Online

Online Link: https://meet.google.com/koa-xrqx-vju

Abstract

Fusion reactor material must possess thermo-mechanical stability and chemical inertness in extremely harsh conditions. The beneficial original properties of materials employed in reactors may be affected by energetic ions, neutrons, and gamma-ray radiation. Insulating materials are essential for such reactors and their properties can be affected even by a small damage dose [1-3].

Alumina (Al_2O_3) is one of the promising materials to be employed in numerous applications such as electrical insulation, diagnostic windows, etc. in fusion reactors due to its good insulating and mechanical capabilities. It has been observed that at a high fluence of SHI exposure, structural properties of Al_2O_3 are impacted [2,4]. Yttria stabilized zirconia (YSZ) has superior radiation resistance, thermal stability, and reduced thermal and electrical conductivity below 1000 ℃ [5,6]. Therefore, Al_2O_3/YSZ composites may perform better in harsh environments and can be used as an alternative to Al_2O_3[6].

We have synthesized yttria-stabilized zirconia/alumina composite using a solid-state route as well as the R-F sputtering method. The post-annealed samples were characterized using XRD, Raman spectroscopy, optical spectroscopy, Rutherford backscattering (RBS), and field emission scanning electron microscopy (FESEM). FESEM images showed unique rectangular micro-pattern morphology. Optical spectroscopy measurements provided insights into the flower-type micro-morphology over a long range of micrometers. The results obtained from pre- and post-annealed sample characterizations contribute to a comprehensive understanding of the structural and microstructural properties of Al_2O_3-YSZ composite and have given a better insight to the process parameters for thin film synthesis. Further, their performance in a radiative environment is to be tested further using ion beam irradiation.

Reference:

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5. X. Song, J. Zhang, Z. Liu, C. Jiang, C. Lin, Y. Zeng, Vacuum,162,150-155 (2019).
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