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Seminar

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Institute for Plasma Research

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Title : Compatibility study between Li_2TiO_3 and India specific reduced activation ferritic martensitic steel

Speaker: Mr. Aroh Shrivastava
Institute for Plasma Research, Gandhinagar

Date : 4th June 2021 (Friday)

Time : 04:30 PM

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

Abstract

India contributes to the ITER project (Experimental fusion machine) in collaboration with China, European Union, Japan, Russia & South Korea. ITER ("The Way" in Latin) is one of the most ambitious energy projects in the world today. In southern France, seven-member countries with 35 nations collaborate to build the world's largest tokamak, a magnetic fusion device. It has been designed to prove the feasibility of fusion as a large-scale and carbon-free energy source based on the same principle that powers our Sun and stars. In future, the ITER machine will provide a platform to test various fusion relevant technologies. Being an ITER member, India has offered vital technologies such as cryostat, cryo lines and several other components.

Once ITER is operational, India has planned to test fusion relevant technologies developed in India. Out of which, fusion blanket is a critical component for heat extraction and tritium breeding. Indian fusion blanket consists of two primary materials which are already developed at Institute for Plasma Research, i.e. Li_2TiO_3 (lithium titanate) & IN-RAFMS (India specific Reduced Activation Ferritic Martensitic Steel). Li_2TiO_3 & IN-RAFMS will contact the fusion reactor at a high temperature up to 550 °C. These materials will be in the environment of low pressure helium with a small amount of hydrogen. Under these conditions, the element present in functional and structural material may react with each other and may change the properties of the base materials. Chemical compatibility study between these two materials is therefore, very crucial. The planned research may provide a critical database for material research and the design of the fusion blanket.

Researchers have worked on various functional and structural materials; however, chemical compatibility study on this specific combination (Li_2TiO_3 + IN-RAFMS, Helium atm.) is yet to be explored. This project aims to determine the effect of time-dependent chemical compatibility of Li_2TiO_3 and IN-RAFMS under helium atmosphere at 550 °C.

In this study, an experimental setup is designed and fabricated to perform the compatibility study under helium atmosphere at 550 °C. Once the experimental setup was fabricated and operational, the time-dependent chemical compatibility study was conducted. The post-experimental studies were performed with X-ray diffraction, scanning electron microscopy and energy-dispersive x-ray spectroscopy. The time-dependent oxide growth was estimated. The outcome of these experiments provided a critical database about the functional and structural material.

Keywords: ITER, Li_2TiO_3, IN-RAFMS, microstructure, chemical compatibility