Seminar

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Institute for Plasma Research

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Title: Investigation of Thin Layer Activation in Strategically Important Rare Earth Materials

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Date: 14th July 2023 (Friday)

Time: 3.30 PM

Venue: Committee Room No. 4, IPR

Abstract

Thin Layer Activation has gained a significant importance in past few years due to its precise and accurate measurement of wear and other surface phenomena in various industries In the present work, an attempt has been made to explore feasibility of a very new approach of measuring surface activity in some strategically important rare earth materials viz; Terbium, Thullium & Tantalum alongwith Nickel material having wide range of industrial applications and significance. Irradiations with these materials were done to observe nuclear interactions and systematics through direct measurement method in which stacks of respective target materials have been irradiated with heavy ion Oxygen beam available at one of the national laboratory which is Inter University Accelerator Center, New Delhi, India. The standard beam energy range available at accelerator facility was ≈ 70-110 MeV. The experimental setups are mainly designed to investigate nuclear reaction dynamics around the Coulomb barrier energies as a part of nuclear physics experiments. Data obtained through irradiations have been further used to explore the feasibility of TLA based applications to identify specific reaction products in a very thin layer of the material. The results showed that the proposed methodology of measuring surface activity in materials is feasible with high accuracy, precision and can be used in industrial applications to estimate surface degradation phenomena's ranging from few micrometers to nanometers By using TLA, surface degradation in materials can be estimated in few hours as compared to that of the conventional techniques in which component or material specimen are subjected for longer cycles of operation to deduce results. The proposed methodology uses offline γ-spectroscopy arrangement coupled with High Purity Germanium Detector set-up for detection of worn out fraction mass of particles after irradiation. The relative activity induced across the overall thickness of target materials after beam irradiation is the rate of interaction. The rate of interaction between beam and material further estimates the maximum yield and surface activity distribution in material across the entire depth of stack. Results showed the maximum depth of interaction in the form of activity ranges from 12-16μm in rare earth materials specimen of Terbium, Thulium, Tantalum in standard operating accelerator conditions using Oxygen beam & 25μm in Nickel material while using Alpha beams. It would be very interesting extend further research investigations with different rare earth materials combination in exploring significant commercial applications in the field of High temperature Superconductivity areas.