ME - Postdoc Work Presentations

Fretting-Induced Degradation in Zr alloy under Controlled Environment Conditions

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ABSTRACT

In Pressurized Heavy Water Reactors (PHWRs), fuel bundles rest within pressure tubes (PTs) made of Zr-2.5Nb and are supported by bearing pads (BPs) composed of Zr-4. During normal operation, flow-induced vibrations can cause relative displacement between the PT and BP, leading to fretting damage at the contact interface. Additionally, zirconium alloys in PTs absorb hydrogen over time, with excess hydrogen precipitating as brittle zirconium hydride platelets when concentrations exceed the terminal solid solubility limit. Hydride embrittlement, influenced by hydrogen concentration and hydride characteristics, depends on the PT material's crystallographic orientation and stress conditions. Typically, circumferential hydrides form under normal operating conditions. However, cooling under significant stress can induce the formation of radial hydrides, a phenomenon known as stress reorientation of hydrides. The present study aims to quantify fretting damage in Zr-2.5Nb under controlled environmental conditions. Additionally, an attempt will be made to investigate the potential for hydride reorientation under fretting conditions, which is another key area of this study.

ABOUT THE SPEAKER

Dr. Kamini works as an IoE postdoc fellow in Prof. Satish Vasu Kailas's lab in the Department of Mechanical Engineering at IISc. She completed her PhD in the Department of Metallurgical and Materials Engineering at IIT Madras, where she experimentally explored the wear behavior of surface-modified Ti6Al4V using surface modification techniques such as thermal oxidation and plasma electrolytic oxidation. Currently, her research interest includes fretting behavior of Zr alloy for nuclear fuel applications.