Department of Materials Science and Engineering, and
Material Advantage @ IIT Kanpur
jointly present the talk

Nanoimprinting Atomically Smooth Surfaces for Nanoscale Measurements of Bulk Metallic Glasses

Speaker: **Dr. Amit Datye**
Associate Research Scientist, Dept. of Mechanical Engg. & Materials Science, Yale University

Date: Aug. 26, 2021 (Thu) **Time:** 4 pm (IST)
Meeting Link: https://iitk-ac-in.zoom.us/j/96359211200?pwd=NEx6M0F5Rk91S2xScnloZmN1YllMdz09
(Zoom ID: 963 5921 1200, Passcode: 175318)

Abstract:
In recent years, nanoimprinting of bulk metallic glasses (BMGs) by thermoplastic forming has enabled the manufacturing of samples made from $Pt_{57.5}Cu_{14.7}Ni_{5.3}P_{22.5}$ BMG featuring atomically smooth terraces using $SrTiO_3$ single crystals as molds. Due to their sub-angstrom RMS surface roughness, these atomically smooth samples are ideally suited to be used in high-resolution investigations of BMG properties by surface-sensitive methods such as atomic force microscopy. The important aspects of BMG-based replication will be discussed: (i) there is indeed no intrinsic length scale that would limit the accuracy of replication of angstrom-scale surface features, (ii) demonstrating a new route to manufacturing highly accurate crystalline copies of surfaces by heating BMGs in-situ while being pressed into form for sufficiently long times that almost complete crystallization has been achieved; and (iii) introducing an alternative replication methodology based on sputtering amorphous thin films that has the potential to be economic for large-scale industrial application even on soft and temperature-sensitive molds while still providing sub-angstrom replication accuracy. Finally, in this talk, results of nanoscale measurements for studying the effect of annealing-induced relaxation and crystallization on surface morphology and mechanical measurements of atomic flow in glasses will also presented.

Biography:

Amit Datye is currently an Associate Research Scientist in the Department of Mechanical Engineering and Materials Science at Yale University. He received his Ph.D. under the guidance of George Pharr at the University of Tennessee. While working on this PhD and after, he conducted research at the Oak Ridge National Laboratory. He joined Yale University after a brief one year at Cornell University. He is an author or co-author of more than 50 scientific publications (including 4 book chapters) in prestigious journals like Nature Communications, Nature Communications Materials, Nature Communications Physics etc. His research focuses on nanoscale characterization techniques nanomechanics etc. and advanced manufacturing techniques like imprinting and additive manufacturing.