

MECHANICAL ENGINEERING

SEMINAR

Precision net-shaping of amorphous metals: lessons from plastics

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Friday, November 2, 2018

11:00 am, ECSS 2.415

Abstract

Plastics have revolutionized the industry primarily due to ease in manufacturing based on their thermoplastic and thermosetting properties. Components of any shape, size, and surface finish can be readily fabricated from plastics through plethora of existing techniques such as, molding, stamping, blow-molding, extrusion, drawing, lithography etc. In contrast, these methods have limited applicability to metals because of their high melting temperature, surface energy, thermal shrinkage, thermal conductivity, and finite grain size. Discovery of amorphous metals (aka metallic glasses) promises to bridge the gap between metal and plastic manufacturing. Metallic bonds and non-crystalline structure result in unusual properties in metallic glasses such as: high strength and elasticity, good wear/corrosion resistance, thermal/electrical conductivity like metals, and thermoplastic shaping capability like polymers. We exploit the metastable viscous state of metallic glasses to enable new manufacturing methodologies which were previously limited to plastics. Examples of metal nanoimprinting, hierarchical surface texturing, net-shaping of precision microparts, and joining of heterogeneous materials will be discussed. These new techniques allow us to study various fundamental scientific problems and explore novel applications of metallic materials.

Biography

Dr. Golden Kumar is currently an associate professor in the Department of Mechanical Engineering at Texas Tech University. He has worked at Yale University and National Institute of Materials Science, Japan. He received Ph.D. in Physics from Technical University Dresden (Germany) and masters in Materials Science & Engineering from Indian Institute of Technology Kharagpur (India). His current research interests include nonmanufacturing, net-shaping, surface engineering, nanomechanics, size-effects, and optics. He will be joining the department of Mechanical Engineering at UT Dallas in spring 2019.