

SUBMIT AN ABSTRACT FOR THE FOLLOWING SYMPOSIUM

MECHANICS OF MATERIALS

Advanced Materials for Reusable Rocket Engines

New reusable rocket engines currently under development use high efficiency staged-combustion power cycles which subject materials to extreme operating conditions, involving cryogenic temperatures, extreme temperature swings, high heat fluxes, and ultra-high-pressure oxygen. These conditions give rise to a host of catastrophic failure modes, from metal fires to oxidation-assisted fatigue to strain-ratcheting induced creep rupture. Legacy materials were used to design and fabricate current reusable rocket engines. Companies are now racing to update technology and develop new platforms, but the challenges are formidable and require collaborative teams. There are exciting opportunities to apply modern design and development tools and to exploit huge advances in materials over the past 20 years to specifically tailor materials to meet the extreme environments of reusable propulsion systems. The three components that dictate the life of a reusable boost-stage staged-combustion rocket engine are the thrust chamber, turbopump and nozzle. Each operates in disparate conditions that drive distinct failure modes, motivate different material choices, and present unique research opportunities. This symposium will feature talks on the material behaviors and failure modes in these applications as well as novel materials, manufacturing processes, and structures that can overcome these failure modes to unlock advances in reusable rocket engine technology.

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