Microscale Power Generation and Propulsion: It’s Not the Same as Big Devices Made Smaller

Paul Ronney
Professor; Department of Aerospace and Mechanical Engineering, University of Southern California

Despite numerous advantages of fuels over batteries, combustion devices have not yet been employed for electrical power production and propulsion at small scales. Most current micro-scale concepts employ scaled-down versions of existing macroscale devices, though such microdevices experience more difficulties with heat losses, friction, sealing, fabrication, assembly etc. than their macroscale counterparts. This talk will emphasize the science of reacting flows in small-scale devices including (1) performance of spiral counterflow heat-recirculating "Swiss Roll" combustors, (2) catalytic combustion at small scales, (3) power generation using single-chamber solid oxide fuel cells and direct hydrocarbon PEM fuel cells. Practical implementation of these concepts will also be discussed.

Bio: Dr. Paul Ronney is a Professor in the Department of Aerospace and Mechanical Engineering at USC. Prof. Ronney received a B.S. in Mechanical Engineering from Berkeley, an MS in Aeronautics from Caltech, and a Sc.D. in Aeronautics and Astronautics from MIT. He held postdoctoral appointments at the NASA Lewis Research Center and the U. S. Naval Research Laboratory and a position as Assistant Professor at Princeton University before assuming his current position at USC. He was also a Payload Specialist Astronaut (Alternate) for Space Shuttle Missions STS-83 and STS-94 in 1997. Professor Ronney research areas include micro-scale combustion, bioengineering, flame ignition by transient plasma discharges, turbulent combustion, internal combustion engines, microgravity combustion and fire spread. He has had experiments flown on three Space Shuttle missions. In recognition of his achievements he is a Fellow of the American Society of Mechanical Engineers, an Associate Fellow of the American Institute of Aeronautics and Astronautics and a recipient of the National Science Foundation Presidential Young Investigator Award.