Recent advances in microfabrication technologies have enabled the development of entirely new classes of small-scale devices with applications in fields ranging from biomedicine, to wireless communication and computing, to reconnaissance, and to augmentation of human function. In many cases, however, what these devices can actually accomplish is limited by the low energy density of their energy storage and conversion systems.

This breakthrough book brings together in one place the information necessary to develop the high energy density combustion-based power sources that will enable many of these devices to realize their full potential. Engineers and scientists working in energy-related fields will find:

- An overview of the fundamental physics and phenomena of microscale combustion;
- Presentations of the latest modeling and simulation techniques for gas-phase and catalytic micro-reactors;
- The latest results from experiments in small-scale liquid film, micro-tube, and porous combustors, micro-thrusters, and micro heat engines;
- An assessment of the additional research necessary to develop compact and high energy density energy conversion systems that are truly practical.

**Yiguang Ju** is the Robert Porter Patterson professor in the Department of Mechanical and Aerospace Engineering at Princeton University. His research interests include combustion, micropower generation, alternative fuels, plasma assisted combustion, combustion kinetics, and multiscale modeling. He is an ASME Fellow, a recipient of the Friedrich Wilhelm Bessel Research Award, and has 160 journal publications.

**Christopher Cadou** is a Keystone professor in the Department of Aerospace Engineering at the University of Maryland. His research interests include combustion, miniature energy conversion systems, laser diagnostics, fuel cells, and supersonic film cooling. He has authored over 90 articles in books, journals, and conference proceedings.

**Kaoru Maruta** is a professor and deputy director of Innovative Energy Research Center in the Institute of Fluid Science at Tohoku University, Japan and a Head of International Combustion and Energy Laboratory, School of Engineering, Far Eastern Federal University, Russia. His research interests include new concept combustion technology, microcombustion, combustion in microgravity, and combustion with higher exergy efficiency. He is on the editorial boards of major combustion journals, a recipient of the Ichimura Award and has published 85 journal articles.
Recent advances in microfabrication technologies have enabled the development of entirely new classes of small-scale devices with applications in fields ranging from biomedicine (portable defibrillators, drug delivery systems, etc.), to wireless communication and computing (cell phones, laptop computers, etc.), to reconnaissance (unmanned air vehicles, microsatellites etc.), and to augmentation of human function (exoskeletons etc.). In many cases, however, what these devices can actually accomplish is limited by the low energy density of their energy storage and conversion systems.

This breakthrough book brings together in one place the information necessary to develop the high energy density combustion-based power sources that will enable many of these devices to realize their full potentials. Engineers and scientists working in energy-related fields will find here:

- An overview of the fundamental physics and phenomena of microscale combustion;
- Presentations of the latest modeling and simulation techniques for gas-phase and catalytic micro-reactors;
- The latest results from experiments in small-scale liquid film, micro-tube, and porous combustors, micro-thrusters, and micro heat engines;
- An assessment of the additional research necessary to develop compact and high energy density energy conversion systems that are truly practical.

**KEYWORDS**

microscale combustion, flameless combustion, combustion limits, combustion instability, excess enthalpy combustion, small-scale liquid film combustors, micro-tubes and porous combustors, Swiss-roll combustors, catalytic reactors, micro-heat engines, micro-reactors, micro-power generators, micro-thrusters, model aircraft engines, 2-stroke engines, piston engines, heterogeneous combustion, catalytic combustion, conjugate heat transfer, scale-effects on combustion, thermoelectric power generation, micro gas turbine engine, micro-rotary engine, micro-rockets, microfabrication, MEMS