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JSS Focus Issue on Thermoelectric Materials & Devices

Preface—Focus Issue on Thermoelectric Materials & Devices: Phonon Engineering, Advanced Materials and Thermal Transport

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This focus issue addresses some of the cutting edge research themes in thermoelectric materials growth, phonon engineering to control thermal conductivity, new characterization methods, and advances in thermoelectric material applications. Controlling heat transport, dissipation, and its conversion to other forms of energy are major research drivers for both materials researchers and device/product specialists, and the pursuit of higher thermoelectric figures of merit can benefit from research on phonon transport physics, materials science, electronics, condensed matter physics, engineering, the chemistry of materials, and processing technology. Individual advances in these sub-fields can inspire developments in thermoelectrics that may underpin the next major advance in energy harvesting and cooling and ultimately improve the quality of our devices, and help drive energy efficiency and a greener society.

This issue and the symposia on "Thermoelectric and Thermal Interface Materials" held at ECS meetings provide a forum for high quality and cutting edge dissemination of research papers, critical review articles, and communications spanning the fundamental science of heat conduction, advances in thermoelectric and thermal interface materials, and their application to the development of heating, cooling, energy harvesting, and technology development for electronic, photonic, and related devices.

In this issue, readers will find extensive reviews on scientific and technical challenges in thermoelectric materials and devices, including advancements in organic thermoelectric materials, and micro- and nano-engineering approaches to next-generation thermoelectric generators. The issue also disseminates new computational screening methods for efficient selection of high performance thermoelectric materials, in addition to a survey of state-of-the-art characterization methods for electronic and phononic nanomaterials, critical to heat conduction measurements. Papers in this issue show recent developments in electrodeposition of materials for thermoelectric generators, advances in material science of semiconducting, and metallic materials engineered to enhance phonon scattering to improve thermoelectric performance, self-powdered temperature sensors, a strategy for integrated thermoelectric cooling for silicon photonics, and how molten semiconductors may be used for high temperature thermoelectrics. The issue comprehensively covers a range of important topics in advanced materials, methods, and applications of thermoelectrics.

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