TcSUH SPECIAL SEMINAR

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Room 102, Houston Science Center
4:00 p.m. – 5:00 p.m.

Integrated Thermoelectric Devices Get a Little Cooler, and Finding Applications for Unconventional Superconductors

ABSTRACT: Micro-thermoelectric modules are of potential use in fields such as energy harvesting, thermal management, thermal imaging and high spatial-resolution temperature sensing. In particular, micro-thermoelectric coolers (μ-TECs) – in which the application of an electric current cools the device based on the Peltier effect – can be used to manage heat locally on a micrometer spot in microelectronic circuits, optoelectronic devices and microfluidic channels. However, a cost-effective μ-TEC device that is compatible with the modern semiconductor fabrication industry has been developed. N-type BiTeSe and p-type pure Te were electrochemically deposited at room temperature into microstructured photoresist patterns. The final device performance of μ-TECs in terms of transient responses, cycling reliability and cooling stability has not been adequately assessed. Here we report the fabrication of μ-TECs that offer a rapid response time of 1 ms, reliability of up to 10 million cycles and a cooling stability of more than one month at constant electric current. The high cooling reliability and stability for our μ-TEC module [1] can be attributed to a design of free-standing top contacts between the thermoelectric legs and metallic bridges, which reduces the thermomechanical stress in the devices.

The Leibniz Institute of Materials and Solid State Research has a long research history on unconventional superconductors and the development of devices based on superconducting materials. In the presentation some recent developments will be shown, like synthesis of MgB_2 bulk magnets, fabrication of superconducting tapes based on pulsed laser deposition, and the application of bulk superconductors for magnetic bearings in high performance ring spinning machines.

Ref:
[1] G. Li et al *Nature Electronics* 1, 555 (2018).

Persons with disabilities who require special accommodations in attending this lecture should call 713-743-8213 as soon as possible.

TcSUH Host: Prof. Zhifeng Ren