Colloquium

3D Printed Thermoelectrics: From Bricks to Bridges

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Host: Jorryt Matthee

Abstract: Thermoelectric (TE) devices provide solid-state cooling without the need for refrigerants or mechanically complex systems. Globally, the thermoelectric device market is expected to grow from USD $1.5 billion in 2024 to $4.2 billion in 2033, with even greater potential if manufacturing costs can be further reduced. Current manufacturing of thermoelectric materials and devices often relies on costly, hard-to-scale processes such as spark plasma sintering and machining, which hinder large-scale deployment. 3D printing, particularly direct ink writing, offers an efficient route to fabricating shape-conformable thermoelectric materials and addresses the cost and scalability challenges of conventional methods.In this presentation, I will demonstrate how 3D printing can be harnessed to produce low-cost, high-efficiency TE devices. By developing specialized printable inks, we directly create complex structures with enhanced performance. The printed TE cooler achieves a temperature difference of 50 °C under ambient conditions, demonstrating the feasibility of scalable, high-performance devices. This approach dramatically simplifies the manufacturing workflow, providing a rapid and cost-effective route for TE device production. Beyond advancing TE technology, our work establishes a broader framework for the formulation of functional inks for 3D printing of semiconducting materials, opening new paths for energy-efficient thermal management across applications ranging from electronics to biomedical systems.

Monday, October 20, 2025 11:30am - 12:30pm
Raiffeisen Lecture Hall

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