University at Buffalo
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TUNING THERMAL TRANSPORT AND MAGNETIZATION DYNAMICS IN FUNCTIONAL MATERIALS

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Abstract: Transport phenomena play an essential role in designing and engineering materials with tailored functionalities. Thermal conductivity and interfacial thermal conductance, as basic transport properties of materials and interfaces, can provide a wealth of information on the fundamental scattering processes of charge and thermal carriers with structural defects, boundaries, and interface imperfection. In this talk, I will share our group's activities in advancing ultrafast optical metrology to investigate thermal transport and magnetization dynamics in functional materials spanning a wide range of applications. This will include: (1) tuning thermal transport in single crystals of correlated perovskite oxides using electrolyte gating; (2) unveiling the 3D anisotropic thermal transport in black phosphorus, a notable material for the semiconductor industry; (3) exploring thickness-dependent thermal transport in ultra-wide-bandgap gallium oxide for high-voltage power electronics, and (4) studying magnetization dynamics in perpendicular L10-FePd with buffer-layer engineering and Co/Pd multilayers with spin-strain coupling, both promising for energy-efficient spintronic applications. The structure-property relationships of functional materials revealed by the ultrafast pump-probe technique offer opportunities for tailoring material properties by structural engineering at the atomic and molecular levels. Ultimately, this understanding can guide the design and optimization of materials as building blocks for high-performance power electronics, solid-state energy conversion, spintronics, and data storage.

References:
[1] Zhang et al, Nature Communications, 14, 2626 (2023).
[2] Lyu et al., Advanced Functional Materials, 33, 2214201 (2023).
[3] Huang et al., Physical Review Materials, 6, 113402 (2022).
[4] Zhang et al., Science Advances, 6, eabb4607 (2020).
[5] Wu et al., Advanced Functional Materials, 27, 1704233 (2017).
[6] Zhu et al., Advanced Electronic Materials, 2, 1600040 (2016).

Bio: Xiaojia Wang is currently an associate professor in the Department of Mechanical Engineering at the University of Minnesota, Twin Cities. Prior to this, she was a postdoctoral research associate in the Department of Materials Science and Engineering at the University of Illinois at Urbana Champaign. She received her Ph.D. in Mechanical Engineering from the Georgia Institute of Technology in 2011, and her M.S. in 2007 and B.S. in 2004 from Xi'an Jiaotong University, China, all in Mechanical Engineering. For details, please visit her research group website: https://mnttl.umn.edu/publications

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