Tuning and Mapping the Thermal Spectra of 2D van der Waals Materials

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Two-dimensional (2D) van der Waals materials have been of great research interest recently due to their rich potential for energy conversion, storage, and electronics. The mechanism of the energy transfer process, in particular, the coupling effects between structures, interfaces, and thermal properties, remain to be explored. Here, we describe our current progress on experimentally quantifying and controlling the thermal properties of 2D materials under chemical modifications. Our work focuses on the fundamental understanding and manipulation of the anisotropic thermal properties of novel 2D materials [1]. Using our recently developed thermal spectral mapping technique [2], we demonstrate that this new 2D material system can serve as a uniquely powerful platform for tuning and mapping the phonon spectra at different mean free paths. We expect our study will lead to a new framework for reversible and precise control of heat flow and bring further the promise of rational material design to achieve high performance through a synergistic experiment-modeling approach [3].

[1] Joon Sang Kang, Ming Ke, and Yongjie Hu, Nano Letters 17, 1431–1438 (2017).

[2] Yongjie Hu, Lingping Zeng, Austin Minnich, Mildred S. Dresselhaus, and Gang Chen, *Nature Nanotechnology* 10, 701–706 (2015).

[3] Yongjie Hu, Ferdinand Kuemmeth, Charles M. Lieber, and Charles M. Marcus, *Nature Nanotechnology* 7, 47-50 (2012).