Measuring the in-Plane Thermal Diffusivity in Suspended $MoSe_2$ Thin Films

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Layered materials, particularly transition metal dichalcogenides (TMDs), have attracted strong research interest over the last decade, owing to their many intriguing electrical, mechanical, optical and thermal properties. A thorough understanding of their thermal properties is important to enable thermoelectric, optoelectronic, and medical applications. Nevertheless, the dependence of thermal properties on TMD thickness is not yet well known and are still under extensive scientific debate [1-3].

Here, we experimentally investigate heat diffusion in exfoliated, single-crystal $MoSe_2$ as a function of flake thickness, down to the monolayer limit. We use a novel pre-time-zero spatiotemporal pump-probe microscopic technique [4] to study the in-plane thermal diffusivity (*D*) of dry-transferred $MoSe_2$ crystals that are suspended on large, circular apertures of 15 μm. To date, we have measured ~15 $MoSe_2$ samples of varying thickness, ranging from monolayer (~0.7 nm) to 15 nm. Our results reveal a significant reduction of the thermal diffusivity (*D*) towards the monolayer limit.

These surprising experimental observations highlight the need for a better theoretical understanding of the layer dependence of heat transport properties in transition metal dichalcogenides.

References

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