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European Congress on LASER, OPTICS AND PHOTONICS

November 24-25, 2022 | Webinar

Monitoring folds localization in ultra-thin transition metal dichalcogenides using Optical Harmonic Generation

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Folding is an effective technique to alter the optoelectronic properties of two-dimensional (2D) materials such as interlayer coupling, bandgap, etc. Optical techniques such as PL, Raman were used in the past to probe the folds localization. Here, we show that optical second harmonic generation (SHG), which is sensitive to the crystalline symmetry of 2D materials, is a powerful probe to monitor the fold localization in TMDCs. Two dimensional 2H Transition Metal Dichalcogenides (TMDC) are particularly well-suited for the study because their SHG investigation has already been done, in additional, they can be easily folded due to their high flexibility. Our study includes the fabrication of clean folds on ultra-thin layers of TMDCs, optical characterization of the folds using SHG imaging and theoretical calculations to prove our findings. We find that SHG from the folds is a coherent superposition of the SHG from the individual layers of the fold, with a very small phase difference depending on the folding angle. The SHG response is theoretically calculated as a function of the folding angle. Our results establish SHG as an effective tool to monitor folds localization in 2D TMDCs.

Biography

Ahmed Raza Khan did his PhD from Australian National University. He is working as postdoctoral researcher in School of Engineering, Australian National University. His research interests include linear and nonlinear optics, strain-engineering of nano- materials and non-conventional machining process. He has published many papers, including in high impact journals like ACS Nano, Science Advances, Materials today, and Nano Letters, etc.