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Evolution of phonon and electronic structures of transition metal dichalcogenides as a function of large uniaxial strain ALI DADGAR, Department of Mechanical Engineering, Columbia University, New York, USA, ABHAY PASUPATHY, Physics Department, Columbia University, New York, USA, ELTON SANTOS, School of Mathematics and Physics, Queen's University, Belfast, UK, MARCOS PIMENTA, Department of Physics, UFMG, Belo Horizonte, Brazil, E.H. YANG, Deparment of Mechanical Engineering, Stevens Institute of Technology, NJ, USA, KYUNG NAM KANG, Department of Mechanical Engineering, Stevens Institute of Technology, NJ, USA, DECLAN SCULLION, PETER RICE, School of Mathematics and Physics, Queen's University, Belfast, UK, IRVING HERMAN, Department of Applied Physics, Columbia University, New York, USA — Monolayer transition metal dichalcogenides (TMD), like graphene, are highly stretchable materials. The application of uniaxial strain to semiconductor materials changes band gaps, effective masses and scattering mechanisms. Here, we present techniques by which large (several percent) controllable strain can be applied to the semiconducting TMD materials by using polymer encapsulation. Our versatile method allows for the application of both compressive and tensile strain. Using polarized Raman spectroscopy, we monitor the changes to the lattice structure and compare results to those expected from ab-initio theoretical calculations. Using photoluminescence measurements, we track the changes in the excitonic transitions in these materials and show that the optical response of two-dimensional semiconductors is highly tunable using uniaxial strain.

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