Proceedings of the International Conference on Industrial Engineering and Operations Management
Toronto, Canada, October 23-25, 2019

Review of Optical Properties of Two-Dimensional Transition Metal Dichalcogenides

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Abstract

Two dimensional (2D) materials have become a growing subject in the last 15 years mainly due to the success of graphene, which created a completely different class of material based on its unique, single-layer design. Since then, various stable materials of few atoms thick are showing promising capabilities in optical electronics and photonics. One group of material is monolayer transition metal dichalcogenides (TMDs) which are of the type MX_2, where M is a transition metal (such as Mo, W, and Cr) and is sandwiched between two X atoms, which are chalcogen atoms (such as S, Se, or Te). TMDs can show band gap transformation from the reduction of bulk material to monolayers in a 2D plane. The behavior of such materials at the two-dimensional level has created interest in studying optical capabilities for 2D semiconductors. These materials are showing light interaction over a broad bandwidth from far infrared (FIR) to ultraviolet (UV) wavelengths. The materials allow for photodetection in this bandwidth without the need for cooling, creating new potential for optoelectronics. Here, we review these TMDs and their interaction with light for different applications.