Modeling of the optical characteristics of transition metal dichalcogenide solid alloys for photovoltaic applications

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The key elements of pulsed lasers are saturable absorbers [1]. The main requirements for materials for saturable absorbers, are good absorption characteristics, namely high damage threshold [2].Relatively recently, TMDs have been able to establish themselves as the most promising materials for this task. They provide instantaneous saturation, high stability and a wide range of operating wavelengths. In spite of all the advantages of TMDs, they have a heterogeneous absorption spectrum. However, it should be noted that absorption in these materials at wavelengths other than exciton resonance is almost absent. All of this makes it possible to expand the spectral range of the resonators. One way to solve this problem, may be the use of solid alloys based on TMD.In this work we investigate the possibility of using solid alloys based on 2D TMDs with spectrally homogeneous optical absorption at their exciton resonance wavelengths. Since the resulting absorption parameters in the structure can be influenced by many parameters, including the thickness of the layers and the combination of component concentrations, through which the operating wavelengths can be changed. To take this into account, the absorption of the structure at different thicknesses at their exciton resonance wavelengths has been simulated. The optimal ratios of parameters in solid alloys at which uniform optical absorption is observed were identified.

[1] Jing L and et al 2021 *Adv. Opt. Mater.* 2100699

[2] Manzeli S, Ovchinnikov D, Pasquier D, Yazyev O V and Kis A 2017 *Nat. Rev. Mater.* **2** 17033