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Abstract View Online

Application of transition-metal dichalcogenides beyond general electronics

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Abstract

Transition-metal dichalcogenides (TMDs) are novel layered materials for various kind of application. In particular, those formed in hexagonal prismatic structure (Figure 1a) with group-VIB transition-metal are semiconductors in nature and show good transistor performance and strong light-matter interaction. However, the potential application of group-VIB TMDs is not only limited to such general electronics and optics, but also covers next-generation electronics of spintronics and valleytronics including the coupling to the optical polarization (Figure 1b) [1]. Owing to the lack of the inversion centre in the individual layer, the six conduction band minima and valence band maxima at the edge of the hexagonal Brillouin zone split into two groups, creating a valley degree of freedom. Optical interband transition at these high symmetry points are further coupled to the helicity of light. In addition, the heavy transition-metal elements leads to a large spin-orbit interaction and a consequent spin splitting.

Here, I will report our recent research aiming at next-generation electronics, including optoelectronic device utilizing valley degree of freedom [2,3] and the fundamental investigation of the spin relaxation in TMDs [4].

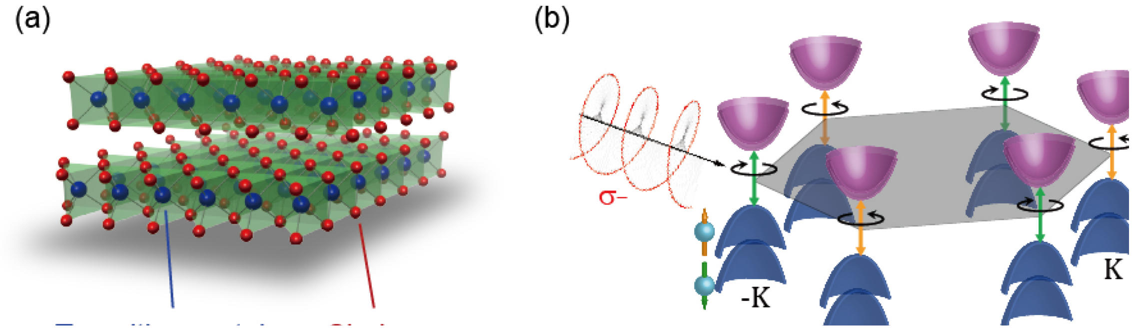

Figure 1. *Crystal structure (a) and band structure (b) of group-VIB transition-metal dichalcogenides.*

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