Exploring the Frontiers of Optical Anisotropy in van der Waals Materials: Opportunities and Obstacles

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Abstract

Materials with high optical anisotropy are of great importance in technology and science [1]. Recently, one of the largest birefringence in the visible and near-infrared intervals up to 0.8 was reported in quasi-one-dimensional crystal $BaTiS_3$ [2]. However, anisotropic nanophotonics requires optical anisotropy of about 1.5 to fully exploit advantages of anisotropic properties [3, 4]. Inspired by this challenge, we focused on two-dimensional materials and their bulk counterpart – van der Waals (vdW) materials. Our findings showed that their fundamental difference between interlayer strong covalent bonding and interlayer weak van der Waals interaction leads to unprecedented high birefringence with values exceeding 1.5 in the infrared and 3.0 in the visible spectral intervals (for example, see optical constants of MoS_2 in Figure 1). Thus, our studies enable a new field of vdW anisotropic nanophotonics.

References

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Figures

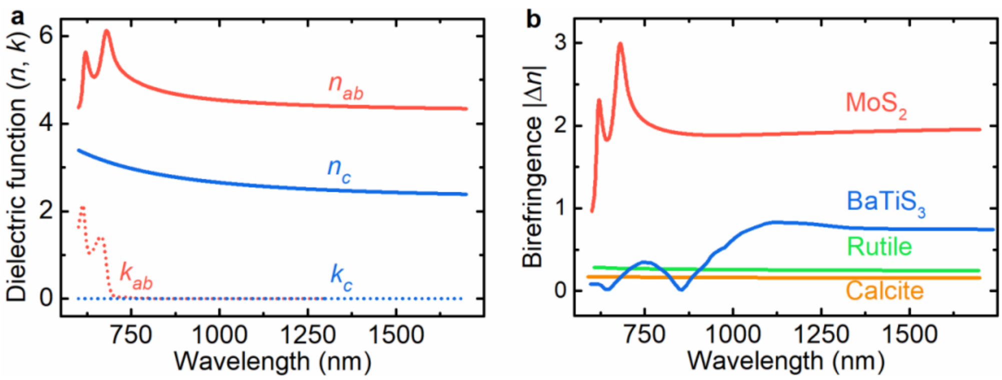

Figure 1: a. Optical constants of MoS_2. **b.** Birefringence of MoS_2 in comparison with other anisotropic materials.