DIELECTRIC FUNCTION AND SINGULAR OPTIC AXES OF KTP

C. Sturm and M. Grundmann

Felix-Bloch-Institut für Festkörperphysik, Linnéstr. 5, Universität Leipzig, Germany

Potassium titanyl phosphate ($KTiOPO_4$, KTP) is an optically biaxial material which is widely used in applications such as for second harmonic generation (SHG) in general and in diode pumped lasers. Although the components of the dielectric tensor in the transparent spectral range are well known there are only few reports for the absorption spectral range, limited to the onset of the absorption.

Here we present the full dielectric tensor in the spectral range from 0.5eV up to 8.4eV. From a line shape analysis of the dielectric tensor components, the properties of the electronic transitions were deduced and the fundamental band gap energy was determined to 4.2eV for dipoles polarized along the *c*-axis. For the transitions polarized along the *a* and *b* direction, the gaps are blue-shifted by 0.70eV and 0.05eV, respectively.

Based on the determined dielectric tensor, the orientation and dispersion of the (singular) optic axes are investigated (Fig.1). As soon as the absorption sets in at an energy of about 3.5eV, both optic axes split into two singular axes [1] and thus, KTP can be considered as optically four-axial in this spectral range. Along such a singular optic axis, either a left or right-hand circular polarized wave can propagate without changing its polarization state. For energies of about 5.55 eV, 6.54 eV, 7.39 eV and 8.22 eV, KTP exhibits a biaxial behaviour since two of the singular optic axes coincide with each other forming a classical optic axis.

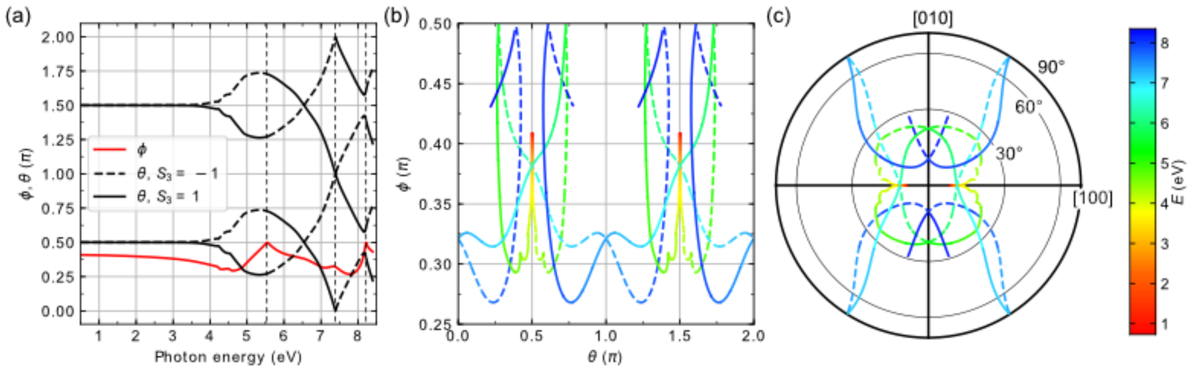

Fig.1. (a) The polar (f) and azimuthal angle (q) of the (singular) optic axes as a function of the energy. The vertical dashed lines indicate the energetic position of the classical optic axes in the absorption spectral range. (b,c) The orientation of the singular optic axis by (b) means of the polar and azimuthal angle ϕ and θ, i.e. the unit vector of the direction is given by $(a, b, c)^T = (\cos\phi, \cos\theta \sin\phi, \sin\theta \sin\phi)^T$ and (c) in the stereographic projection from the upper hemisphere onto the (a,b) plane.

Keywords: singular optic axes; dielectric function; optical anisotropy

References

[1] C. Sturm and M. Grundmann, Phys. Rev. A 93 (2016) 053839.