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Title

Terahertz optical-hall effect for multiple valley band materials: n-type silicon

Source

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Abstract

The optical-Hall effect comprises generalized ellipsometry at long wavelengths on samples with free-charge carriers placed within external magnetic fields. Measurement of the anisotropic magneto-optic response allows for the determination of the free-charge carrier properties including spatial anisotropy. In this work we employ the optical-Hall effect at terahertz frequencies for analysis of free-charge carrier properties in multiple valley band materials, for which the optical free-charge carrier contributions originate from multiple Brillouin-zone conduction or valence band minima or maxima, respectively. We investigate exemplarily the room temperature optical-Hall effect in low phosphorous-doped n-type silicon where free electrons are located in six equivalent conduction-band minima near the X-point. We simultaneously determine their free-charge carrier concentration, mobility, and longitudinal and transverse effective mass parameters. [All rights reserved Elsevier]. (19 References).