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Abstract:This work introduces the potential application of terahertz (THz) sensing to the field of ophthalmology, where it is uniquely suited due to its nonionizing photon energy and high sensitivity to water content. Reflective THz imaging and spectrometry data are reported on ex-vivo porcine corneas prepared with uniform water concentrations using polyethylene glycol (PEG) solutions. At 79% water concentration by mass, the measured reflectivity of the cornea was 20.4%, 14.7%, 11.7%, 9.6%, and 7.4% at 0.2, 0.4, 0.6, 0.8, and 1 THz, respectively. Comparison of nine corneas hydrated from 79.1% to 91.5% concentration by mass demonstrated an approximately linear relationship between THz reflectivity and water concentration, with a monotonically decreasing slope as the frequency increases. The THz-corneal tissue interaction is simulated with a Bruggeman model with excellent agreement. THz applications to corneal dystrophy, graft rejection, and refractive surgery are examined from the context of these measurements.
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