467. Title:Tuning the conduction mechanism in niobium-doped titania nanoparticle networks
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Abstract:Networks of niobium-doped TiO2 anatase nanoparticles with variable doping concentrations were investigated by time-domain terahertz spectroscopy and microwave impedance spectroscopy. A detailed description of their electromagnetic response is proposed; the model takes into account the depolarization fields of inhomogeneous samples and allows us to understand the conductive and dielectric response of individual nanoparticles. We find that electron hopping is the dominating contribution to the conductivity at terahertz frequencies and that the dielectric losses of TiO2 nanoparticles are enhanced in comparison with bulk anatase. The conductive properties of nanoparticles can be tuned via synthesis conditions and thermal posttreatment. In particular, annealing at elevated temperatures improves the nanoparticle crystallinity, reduces the density of structural defects, and enhances the conductive percolation of the network. The developed model of the conduction processes can be helpful for interpretation of charge transport in other semiconducting nanoscale materials.