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Title:Broadband spectroscopy of the complex conductivity of polycrystalline yttria-stabilized zirconia

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Abstract:Broadband conductivity spectra from 100 to 1014 Hz (100 THz) were acquired for yttria-stabilized zirconia (10 mol% Y_2O_3-doped ZrO_2, 10YSZ) to quantify contributions from conduction due to the electrolyte-electrode interface, grain boundaries, universal dielectric response (UDR), and optical phonons. The UDR contribution governed the intrinsic conductivity at all frequencies except specific frequencies in the terahertz range, where phonon contributions governed conductivity for both ceramics and single crystals. UDR parameters σ_0 and σ_{dc} increased with increasing temperature, resulting in increased microwave conductivity. The complex conductivity converged at frequencies of hundreds of gigahertz due to a decrease in the power-law constant, s, with increasing temperature. The optical phonon contribution to the total conductivity, due to an increase in the damping factor Γ_{1TO} with increasing temperature, was small, while the phonon-mode frequency Ω_{1TO} affected the microwave conductivity of 10YSZ.

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