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Abstract:Complex conductivity wideband spectra from 10⁻¹ to 10 ¹⁴Hz (100THz) were determined for 8 mol % yttria-stabilized zirconia (8YSZ) and 8mol% ytterbia-stabilized zirconia (8YbSZ) ceramics. The contributions of electrolyte-electrode interfaces, grain boundaries, intragrain ion-hopping, and optical phonons were quantified to relate the microscopic conduction behavior to the overall conductivity. Intrinsic conductivity was mostly governed by ion-hopping. For both 8YSZ and 8YbSZ, ion-hopping followed the universal dielectric response (UDR) for broadband frequencies except for the phonon dispersion frequencies. The higher overall conductivities of the 8YbSZ ceramics compared to the 8YSZ ones were attributed to differences in the UDR contributions. The dominant factor determining the difference in the intrinsic conductivity in broadband frequencies from direct current (DC) to microwave between the 8YSZ and 8YbSZ ceramics was the DC conductivity due to UDR, σ<inf>dc</inf>, where σ<inf>dc(8YbSZ)</inf> > σ<inf>dc(8YSZ)</inf>. Other parameters in the UDR and the optical parameters did not greatly influence the intrinsic conductivities. © 2012 The Japan Society of Applied Physics.
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Controlled terms:Ceramic materials - Grain boundaries - Ions - Phonons - Terahertz spectroscopy - Zirconia
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