

Dielectric Spectroscopy Investigation of Hydrophobic Silica Aerogel

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Abstract : In recent years, silica aerogels have attracted great attention due to their outstanding properties, and their wide variety of potential applications such as microelectronics, nuclear and high-energy physics, optics and acoustics, superconductivity, space-physics. Hydrophobic silica aerogels were successfully synthesized in one-step by surface modification at ambient pressure. FT-IR result confirmed that Si-OH groups were successfully converted into hydrophobic and non-polar Si-CH₃ groups by surface modification using trimethylchloro silane (TMCS) as co-precursor. Using Alpha-A High-Resolution Dielectric, Conductivity and Impedance Analyzer, AC conductivity of samples were examined at temperature range 293-423 K and measured over frequency range between 1-106 Hz. The characteristic relaxation time decreases with increasing temperature. The AC conductivity follows $\sigma_{AC}(\omega) = \sigma_{DC} + A\omega^s$ relation at frequencies higher than 10 Hz, and the dominant conduction mechanism is found to obey the Correlated Barrier Hopping (CBH) mechanism. At frequencies lower than 10 Hz, the electrical conduction is found to be in accordance with DC conduction mechanism. The activation energies obtained from AC conductivity results and it was observed two relaxation regions.

Keywords : aerogel, synthesis, dielectric constant, dielectric loss, relaxation time

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