



Properties of Silica-Based Aerogel Substrates and Application to C-Band Circular Patch Antenna

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Abstract:

Silica aerogel is a lightweight and low-permittivity dielectric material that possesses attractive features for use as an antenna substrate. In this paper, we characterize the radio frequency and microwave dielectric permittivity properties of substrates composed of silica aerogel encapsulated in polymer aerogel in the frequency range from 10 MHz to 8.5 GHz. Characterized silica-based aerogel substrates show relative permittivity values varying between 1.055 and 1.25 and loss tangent values ranging from 5.08×10^{-4} to 0.0206. Silica-based aerogel substrates thus have the potential of use in designing antennas with high gain and large bandwidth. Validation is presented by characterizing the performance of a manufactured C-band circular patch antenna on silica-based aerogel substrate. The performance is also compared to a design that uses Rogers Duroid RT5880 substrate. The results reveal that the silica aerogel substrate antenna at 7.2 GHz provides 1.5 dB increase in gain, 88% enhancement in bandwidth and 68.5% reduction in mass, in comparison with the antenna on RT5880 substrate.

Keywords:

Silica aerogel low-permittivity substrate high-gain antenna wideband antenna

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