OPTICAL PROPERTIES OF CUBIC MESOPOROUS SILICA THIN FILMS

Soojung Claire Hur and Laurent Pilon

Mechanical and Aerospace Engineering Department
Henry Samueli School of Engineering and Applied Science
University of California, Los Angeles - Los Angeles, CA 90095, USA
E-mail: pilon@seas.ucla.edu

ABSTRACT. Mesoporous silica thin films are used or being considered for various thermal, optical, and electronic applications since their optical properties can be optimized by fine-tuning their porous characteristics. The present study reports, for the first time, a thorough investigation of mesoporous silica thin film composition, morphology, roughness, thickness, pore size and porosity over the spectral range from 400 to 900 nm. The thin films are synthesized based on the evaporation induced self-assembly process and feature constant inter-pore spacing, pore diameter, and porosity measured as 5.95 $\pm$ 0.6 nm, 5 $\pm$ 0.5 nm, and 31%, respectively. Moreover, surface roughness measurements indicate that all films are optically smooth. In addition, the thickness and the effective refractive index of the films are retrieved from normal spectral reflectance measurements. The retrieved thickness agrees well with that measured using the stylus profilometer. The effective refractive index is insensitive to thickness variation as the film thickness exceeds 300 nm when it falls between the parallel and the VAT models.
Keywords: nanoporous media, low-k dielectrics, thin films optics, optical properties, effective medium approximation