

Enhanced mechanical properties of ATMS/SBA-15 composite films by dual forms

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We report a new dual-coating method for the deposition of SiCOH ATMS low-k films on mesoporous SiO₂ (SBA-15)/PEG (polyethylene glycol) composite films to improve the dielectric constant and mechanical properties of SiCOH/SBA-15 dual forms. The deposition is achieved via a two-step process: (i) pre-treatment, mixing SBA-15 with a dispersion of PEGs containing DI-water and formation of SBA-15/PEG composite films by spin-coating, and (ii) post-treatment, deposition of SiCOH films on SBA-15s functionalized with PEGs and post-thermal annealing. SiCOH/SBA-15 dual forms exhibited a 20% reduced dielectric constant without significant loss of mechanical properties in comparison with SiCOH only films after post-thermal annealing. Optical spectroscopy (SEM, TEM), XRD, BET, FT-IR, and XPS results show that such enhanced electrical properties can be attributed to mesoporous SiO₂ and additional porosity through removal of PEG and C_xH_y (thermally labile phase in SiCOH films) after post-thermal annealing.