Deposition of Poly[2-(perfluorooctyl)ethyl acrylate] by the Displacement of Two Immiscible Supercritical Phases (DISP)

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Deposition from two immiscible supercritical phases (DISP), in which a solution of supercritical carbon dioxide (scCO2) with a desired solute is displaced by supercritical helium (scHe), has been applied to deposit poly[2-(perfluorooctyl)ethyl acrylate] (PFOEA) on silicon wafer substrate coupons. The polymer was precipitated at the interfacial boundary between the supercritical He phase and the supercritical CO2/PFOEA solution phase and deposited on the substrates. Depending on the deposition conditions, two different deposition regimes – a particle formation regime and a film formation regime – were found. At low solution concentration or high displacement velocity, particles in the range of 1-3 μm in diameter formed while at high solution concentration or low displacement velocity, films in the range of 30-500 nm in thickness formed. Optical microscopy and atomic force microscopy (AFM) were used to characterize film morphology including drying defects and film roughness. The film deposited from DISP was much thicker and more uniform than the film formed using Freon113.