

Properties and Transport Behavior of Perfluorotriptylamine (FC-70)-Doped Amorphous Teflon AF 2400 Films

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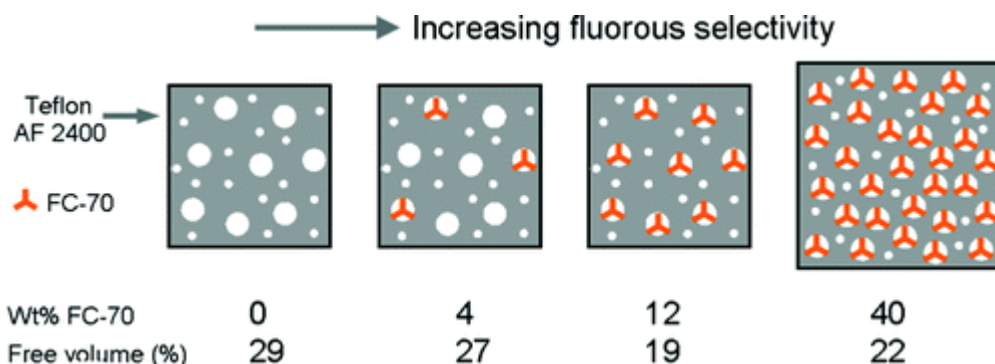
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Teflon AF 2400 films are known to imbibe solvents, making films in the presence of solvents less fluorous than they might otherwise be. Herein, we demonstrate that doping films with perfluorotriptylamine (Fluorinert FC-70) maintains the fluorous nature of Teflon AF 2400 and improves transport selectivity for fluorine-containing organic compounds. Density measurements on the FC-70-doped films reveal that free volume decreases dramatically as the dopant concentration increases (0–12 wt %) and then increases to approach that of pure FC-70. Remarkably, films from 0 to 12 wt % FC-70 have the same w/v concentration of Teflon AF 2400, indicating that FC-70 fills the free volume of Teflon AF 2400. This is consistent with the observed increased storage modulus and significant decrease (compared to undoped films) of solute diffusion coefficients in the same range of FC-70 concentrations. In contrast, FC-70 at concentrations greater than 12 wt % dilutes Teflon AF 2400, leading to a decrease of storage modulus and dramatic increase in solute diffusion coefficients. Sorption of chloroform decreases from 11.8 g of chloroform/100 g of film (pure Teflon film) to 3.8 g of chloroform/100 g of film (27 wt % FC-70-doped Teflon film), less than the solubility of chloroform in pure FC-70 (4.06 g of chloroform/100 g of FC-70). Solute partition coefficients from chloroform to FC-70-doped films generally decrease with increased dopant concentration. However, within a series of toluenes and nitrobenzenes, selectivity for F-containing solutes over analogous H-containing solutes increases as dopant concentration increases if the substitution is on the aromatic ring but not if it is on the methyl group (toluene). Transport (partitioning \times diffusion) rates, as they involve both thermodynamic and kinetic factors, are not simply related to composition.