

Suppression of Coffee-Ring Deposition by Controlled Hydrophobic Interactions

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When a drop of liquid dries with a pinned edge on solid surface, it shows characteristic ring-like deposit at the edge. This phenomenon is known as the coffee-ring effect, which is mainly due to the unbalanced capillary flow during the drying process. The uniform deposition of particles from solutions is a crucial factor in printing and coating processes and future technology such as inkjet printing, DNA chip and self-assembly. In this study, we provide a useful guide to control the deposit pattern of particles by changing the solvent properties with a small amount of hydrophobic and/or hydrophilic chemicals. The polystyrene particles with uniform diameters of 0.8, 1.3, 2, and 3 μm were used as suspended particles for the drying process. We found that several organic chemicals such as 3-methyl-1-butanol, tert-butyl methyl ether, cyclopentane, 1,4-dioxane, tetrahydrofuran, and 1-propanol change the solvent chemistry, leading to the suppression of coffee-ring deposition of particles.