Size dependent self-organization of colloidal particles on chemically patterned surfaces

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Abstract

Self-organization of colloidal particles is interesting and has been studied for the purposes of many applications including nanotechnology, photonics and biotechnology. When a colloidal suspension is dispersed onto a clean surface, colloidal particles form compact structures on the surface as the solvent evaporates. Ordered monolayers may form due to capillary forces between the particles. The growth of monolayers is promoted if the contact angle is small so that only a monolayer of colloidal particles can be accommodated within the evaporating front of the liquid, i.e. the wetting of the substrate by the solvent is an important factor. Self-assembled compact structures or monolayers can also be produced on chemically patterned surfaces. In this case, patterning means creating either a contrast in terms of hydrophilicity or alternately charged regions on a surface. Hydrophilicity of a surface can be tailored by employing micro-contact printing using n-alkyl molecules. We present a study of self-organization of colloidal particles during evaporation of particle solutions on chemically patterned surfaces. On a surface with hydrophilic and hydrophobic regions, colloidal particles form compact structures on the hydrophilic sites. When a colloidal solution containing a mixture of particles with a variation in size is used, the number density of each type of particles deposited on the hydrophilic islands after evaporation decreases with the increasing particle size. This makes it possible to produce a concentration gradient of the particles on islands of different sizes. It is shown that this technique could allow for particle separation.