Self-assembly of colloidal monolayers with anisotropic polymer particles

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Colloidal monolayers represent a versatile nanostructure with many applications in optics and templating. Whereas the fabrication of large-scale, highly-ordered particle layers is well established for isotropic spheres [1, 2], little work has been reported on monolayers based on anisotropic objects. One reason for this shortcoming is the limited availability of monodisperse polymer particles with anisotropic shape. In this contribution, we demonstrate a scalable fabrication route based on the stretching of polystyrene particles (diameter ~ 390 nm) embedded in a polyvinyl alcohol matrix [3].

The resulting anisotropic meso particles were produced in sufficient quantity (5 wt% solutions) and with different aspect ratios (2:1, 3:1, and 4:1; see Fig. 1) exhibiting rice corn shapes.

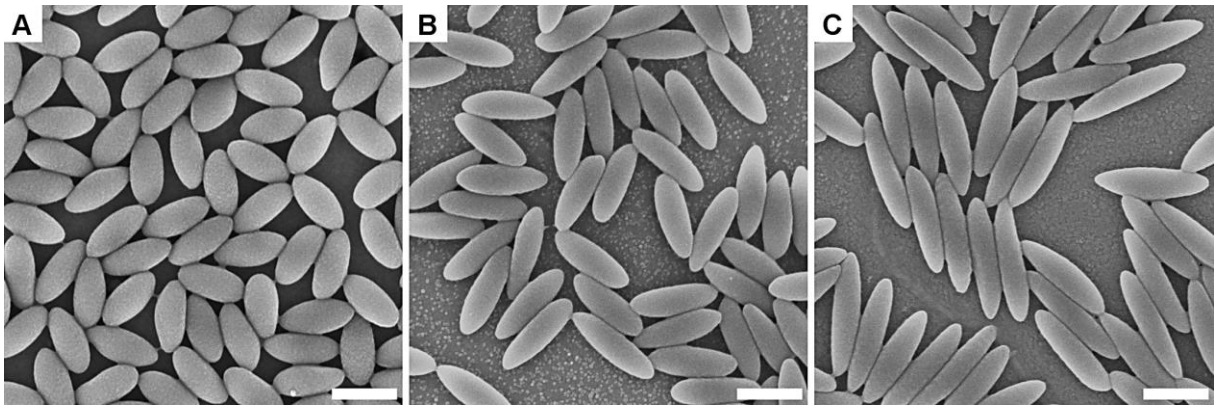

Figure 1. Anisotropic polystyrene beads with different aspect ratios: (A) 2:1, (B) 3:1, and (C) 4:1 (scale bars are 500 nm)

These anisotropic beads were systematically used for the fabrication of colloidal monolayers. We investigate the influence of the particle aspect ratio on the monolayer quality and the mutual orientation of crystal face boundaries. We, furthermore, demonstrate the applicability of a recently developed interfacial stretching process towards non-hexagonal symmetries with these particles [4].

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