

Influence of Corrugated Surfaces Templates in Colloidal Crystal Thin Films Growth

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The influence of patterned surface on the growth of thin film colloidal crystals has been studied experimentally. Confined colloidal crystals show a manifold variety of closed packed structures, strongly dependent on the confinement length.[1-4] Also, the influence of substrates with topographically patterned surfaces has been demonstrated on the formation of three dimensional (3D) closed and non-closed packed colloidal crystals.[5-8] Templated growing surfaces have also been used to achieve zero dimensional (0D) and one dimensional (1D) colloidal nanostructures.[9]

We have built a wedge cell with a new confinement condition, using a flat and a corrugated plate. We make use of inexpensive grating substrates obtained from commercially available Digital Versatile Disks (DVDs) to process large size patterned surfaces. The new variables in the wedge confinement, introduced by the corrugated surface, groove size, pitch of the substrates, as well as the cell thickness value, dictate the particle decoration deposited on both the patterned and non-patterned confining plates.

We have analyzed the influence of patterned surfaces on the formation of one- and two-dimensional colloidal crystals. When the sphere diameter is of the order of the groove width of patterned substrates, a rich variety of particle decorations appear. However if particle size is much larger than template patterns, large domains of particle ordering are formed (Figure 1). Patterned substrates can also be useful for templating colloidal arrangements on flat substrates (Figure 2). Figure 3 shows the results obtained on the corrugated surface of the cell, in quasi-2D colloidal orderings, as our proposal theoretical models.

References

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Figures

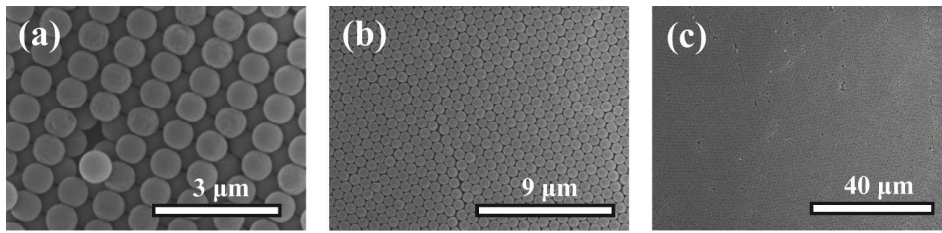


Figure 1. SEM images of particles whose size is larger than the groove width (particle size=770 nm) attached to the corrugated plate, being (a) buckling phase (b,c) triangular phase, being (b) a zoom image of (c).

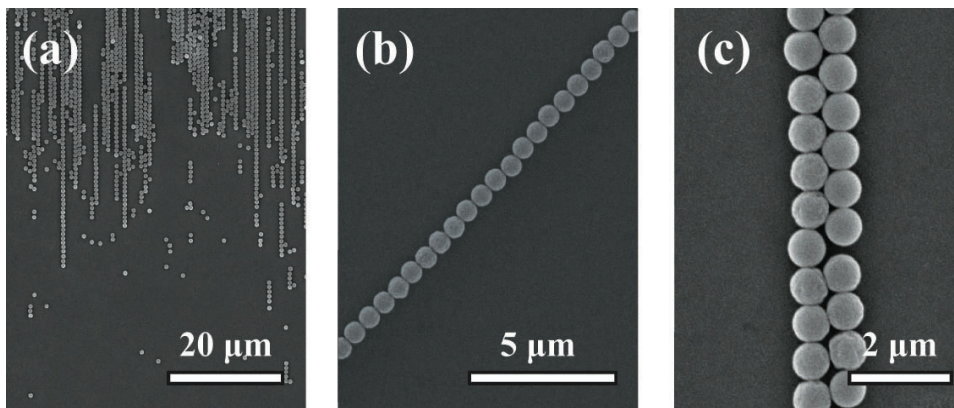


Figure 2. SEM images: (a) a parallel collection of particles rows, (b) a row of spheres arranged linearly, and (c) a strip composed by two rows. In all cases the particle size is 770 nm, and placed over the flat substrate.

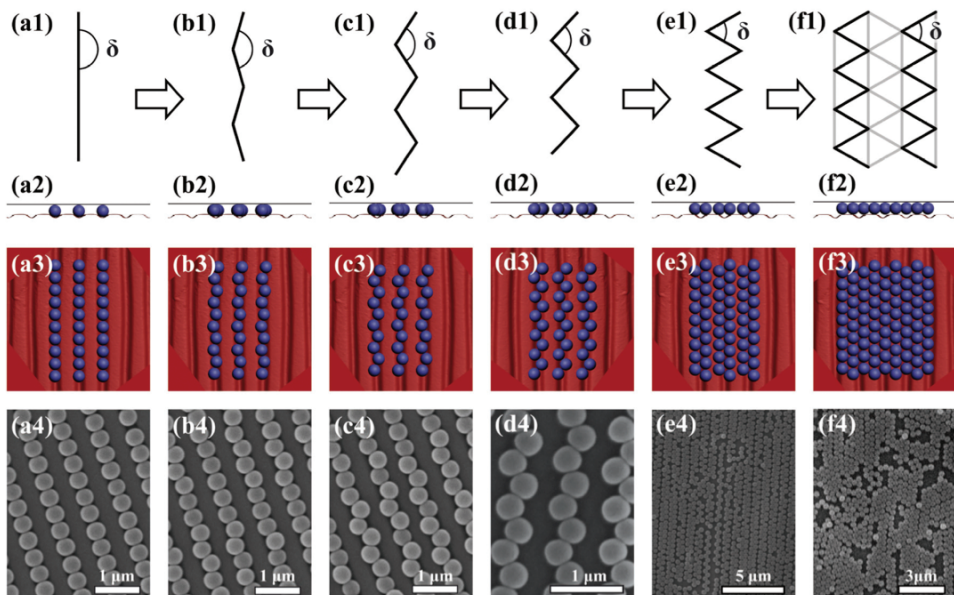


Figure 3. SEM images (bottom row) of different particle orderings, the cell thickness increasing from the left to the right side of the panel. Side (second row) and top (third row) views of the ordering model showing the sphere distribution in the grooves. The first row shows how the zig-zag angle of particle strips changes from 180 degrees (a) to 60 degrees (e). (f) A triangular arrangement of close packed spheres. The particle size is 380 nm.