Segregation Effects in Confined Colloidal Mixtures

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The confinement of colloidal particles was studied resorting to Monte Carlo simulations. We have started by considering systems possessing a relatively large number of the colloids enclosed in a spherical cell. The properties of one of the colloids was then varied in respect to the charge and size. It was found that under certain circumstances this colloid was displaced from the centre of the cell to the cell walls.

The preferential positioning of the colloids in the cell was evaluated by radial density distributions, the interactions between the different components were assessed using radial and nearest-neighbour distribution functions, and the segregative behaviour of the colloid and bulk colloid cluster formation were analysed resorting to a chemometric method (cluster analysis) which discriminates areas with different colloid densities.

The segregation effect was found to be mainly related with ion correlations between the bulk colloids, in a phenomenon that resembles the Brazil nut effect.

Representative snapshots of colloidal systems containing one large neutral colloid and smaller (left) neutral or (right) charged bulk colloids. In the system to the right, which shows colloid segregation, the electroneutrality of the system is achieved using trivalent counterions.

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