We investigate the phase behaviour of soft repulsive charged bowl-shaped colloidal dispersions using confocal laser scanning microscopy (CLSM). These anisotropic particles were obtained by nanoengineering spherical composite microgels, consisting of a polystyrene core surrounded by a crosslinked poly(N-isopropylmethacrylamide) shell, into a bowl shape following the method developed by Im et al. [1] as shown in our former study [2]. In deionized conditions, we observe a transition from a fluid to a plastic crystal phase, with freely rotating particles, to a glassy state with increasing number density. In comparison to spherical particles, the glass transition occurs at a significantly lower number density, indicating that the bowl shape frustrates crystallization. The evolution of the structural properties was determined through the analysis of the pair correlation function and the translational and orientational dynamics was followed by computing the respective mean square displacement up to the glass transition. In addition, an AC electric field was employed to manipulate the particle orientation and self-assembly. The field aligns the particles along their long axis and changes the particle interactions from soft repulsive to dipolar. We find that string-like structures are formed at low concentration and, surprisingly, that at high concentrations the filed induces a reversible transformation of the glassy state to a BCT-like crystal.

Figure 1 (a) TEM and (b) SEM image of bowl-shaped composite microgels. (c-d) CLSM images of (c) plastic crystal phase (inset) time averaged image showing spherical shapes due to freely rotating particles (d) glassy state (inset) that is transformed into a BCT-crystal by a perpendicular E-field.