Patchy colloids: how to endow nanoparticles with valence in order to mimic any conventional molecule, macromolecule or covalent crystal

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Our ability to assemble 3D structures from particles is limited by the absence of specific directional bonds prohibiting the fabrication of low-coordination structures. The Holy Grail is to synthesize colloidal analogues of atoms with valence dictated either by anisotropic shape, *e.g.* dimpled particles, or by anisotropic surface chemistry, *e.g.* patchy particles.

Our strategy is based on a seeded emulsion polymerization process leading to biphasic particles, which are composed of spherical silica spheres surrounded by a varying number of polystyrene nodules. The hydrophilic surface of the silica seed particles (50-150 nm) needs to be previously functionalized. In such conditions, the nucleation/growth of the PS nodules is highly promoted at the silica surface, leading to multipod-like morphologies: bipods, tetrapods, hexapods, octopods, etc. While varying experimental conditions, the key parameters were evidenced.

The talk deals with recent insights in the high yield and repeatability of the synthesis process, the thorough characterization of the multipod-like clusters by cryo-electron tomography, the development of a model to help the understanding of the formation mechanism of almost pure suspensions of well-defined clusters, the use of these clusters as precursors of dimpled nanoparticles, and the derivatization of them in unconventionally shaped inorganic nanoparticles, such as gold nanocages, silica/gold multipod-like replicas, *etc*.

Keywords: silica, polystyrene, gold, patchy particles, site-specific seeded growth, self-assembly, nanocages.

References: *Polym. Chem.* **3**, 1130 (2012); *Langmuir* **28**, 11575 (2012); *Angew. Chem. Int. Ed.* **52**, 11068 (2013); *Faraday Discus.* **181**, 139 (2015); *Nanoscale* **8**, 5454 (2016); *ChemNanoMat* **3**, 160 (2017)