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Self-assembly on curved surfaces: the formation of divalent nanoparticles through topological constraints

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It is known that thiolated molecules spontaneously form poly-crystalline self-assembled monolayers (SAMs) on flat gold surfaces. Scanning tunneling microscopy (STM) studies have shown that, in SAMs composed of more than one type of molecule (mixed-SAMs), domains of random shape and size phase-separate. Here we will show that, when mixed SAMs are formed on gold nano-crystals with a radius of curvature < 20 nm, they spontaneously phase-separate into highly ordered domains of unprecedented size. In the case of binary mixture of thiolated ligands on gold particles, domains, only 0.5 nm wide, of alternating composition encircling or spiraling around the metallic core spontaneously assemble. This new family of nano-structured nano-materials shows properties that are determined by this unique morphology, such as solubility. In particular we will show that the order in the ligand shell of these particles imposes the topological presence of at least two diametrically opposed point defects that can be chemically functionalized so to form divalent metal nanoparticles.