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NOVEL HYBRID CRYSTAL-LIQUID PHASE FORMED BY HETEROGENEOUSLY DECORATED COLLOIDAL PARTICLES

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The self-assembly of colloidal particles is a very adequate and promising route to designed materials production that combines high flexibility, cost effectiveness, and the opportunity to create ordered structures at length scales ranging from nano- to micrometers. For many practical applications in electronics, photovoltaics, and biomimetic material synthesis, ordered layered structures are often urgently needed; as such lamellar particle arrangements stand out for their exceptional mechanical and optical features. In this presentation, it will be demonstrated that charged colloidal particles with oppositely charged surface regions (so-called inverse patchy particles) possess the unusual ability to spontaneously self-assemble into different morphologies of (semi-)ordered, layered particle arrangements which are able to maintain their structural stability over a surprisingly large temperature range. This capacity is based on the characteristic bonding pattern that these particles form via their oppositely charged surface regions: stable intra-layer bonds guarantee the formation of planar aggregates, while strong inter-layer bonds favour the stacking of the emerging planar assemblies. These two types of bonds are responsible for the remarkable self-healing properties that support the spontaneous self-assembly. The resulting phases are characterized by parallel particle layers, connected by a relatively small number of intra-layer particles. In case the latter ones are – as a consequence of an increased temperature – mobile and thus form a fluid phase, we encounter a novel hybrid crystal-liquid phase.

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