

# **Programmed Assembly of Janus, Patchy and Dipolar Particles by Electric and Magnetic Fields**

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We will demonstrate how a rich variety of crystals, gels, 2D and 1D structures can be assembled by electric and magnetic fields acting on suspensions of anisotropic Janus and patchy particles. First, we will review the formation of highly organized and/or percolated structures from metallodielectric particles in external electric and magnetic fields. We will report how Janus particles consisting of a dielectric hemisphere and a conductive one could be driven by AC dielectrophoresis into new types of metallodielectric staggered chains and crystals, where the metalized halves of neighboring particles align. "Patchy" metallodielectric particles could form new types of networks and crystals of unusual symmetry by pre-programmed quadrupolar and hexapolar interactions. Magnetic fields could be used for the assembly of particle chains and gels that retain their structure after the field is turned off, but could be disassembled on demand by demagnetization. We will also discuss strategies for electrostatic assembly of Janus microspheres with permanently embedded dipoles. We use discontinuous molecular dynamics (DMD) simulations to explore the assembly, structure and phase diagram of dipolar Janus particles. The simulations demonstrate a variety of phases ranging from colloidal crystals to open gel networks. A few new types of bicontinuous gels were found in the simulations of the assembly of mixtures of dipolar particles. The gels from Janus particles may have unusual rheological and transport properties and could form the basis of new classes of "smart" soft-solid materials.