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Aqueous Lyotropic Liquid Crystalline Frank-Kasper Mesophases

MAHESH MAHANTHAPPA, SUNG A KIM, Univ of Minn - Minneapolis, KYEONG-JUN JEONG, ARUN YETHIRAJ, Univ of Wisconsin - Madison — Amphiphilic molecules undergo water concentration-dependent self-assembly to form lyotropic liquid crystal (LLC) mesophases. LLC morphology selection is directed by cooperative optimization of preferred molecular packing arrangements, which stem from a subtle balance of local, non-covalent interactions. We recently discovered a class of amphiphiles that form a progression of discontinuous micellar LLCs, including two tetrahedrally-closest packed Frank-Kasper phases that exhibit exceptional long range order. This discovery complements recent reports of their formation in thermotropic liquid crystals, neat diblock and tetrablock polymers, and in lyotropic mesophases of block polymers in ionic liquids. Using a combination of MD simulations and experiments, we provide new insights into the mechanisms of formation for these low symmetry micelle phases.

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