Cylindrical micelles by the self-assembly of crystalline-b-coil polyphosphazene-b-P2VP block copolymers. Stabilization of gold nanoparticles

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During the last number of years a variety of crystallization-driven self-assembly (CDSA) processes based on semicrystalline block copolymers have been developed to prepare a number of different nanomorphologies in solution (micelles). We herein present a convenient synthetic methodology combining: (i) The anionic polymerization of 2-vinylpyridine initiated by organolithium functionalized phosphane initiators; (ii) the cationic polymerization of iminophosphoranes initiated by -PR2Cl2; and (iii) a macromolecular nucleophilic substitution step, to prepare the novel block copolymers poly(bistrifluoroethoxy phosphazene)-b-poly(2-vinylpyridine) (PTFEP-b-P2VP), having semicrystalline PTFEP core forming blocks. The self-assembly of these materials in mixtures of THF (tetrahydrofuran) and 2-propanol (selective solvent to P2VP), lead to a variety of cylindrical micelles of different lengths depending on the amount of 2-propanol added. We demonstrated that the crystallization of the PTFEP at the core of the micelles is the main factor controlling the self-assembly processes. The presence of pyridinyl moieties at the corona of the micelles was exploited to stabilize gold nanoparticles (AuNPs).

Block copolymers

Crystallization-driven self-assembly

Cylindrical micelles

Gold nanoparticles

Micelles

P2VP

Polyphosphazene

Self-assembly

gold

metal nanoparticle

organophosphorus compound

poly(2-vinylpyridine)

poly(bis(trifluoroethoxy)phosphazene)

poly(phosphazene)

polymer

polyvinyl derivative

solvent

chemistry

crystallization

macromolecule

micelle

particle size

polymerization

synthesis

Crystallization

Gold

Macromolecular Substances

Metal Nanoparticles

Micelles

Organophosphorus Compounds

Particle Size

Polymerization

Polymers

Polyvinyls

Solvents