

72a Liquid Crystalline Properties of Dendronized Protein Polymers

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We developed a combined biosynthetic route for dendronized protein polymers (DPPs). DPPs have well-defined cylindrical shapes with controlled molecular length and diameter that allow them to self-assemble into highly ordered liquid crystalline (LC) phases. The DPPs consist of an alpha-helical polypeptide core surrounded by grafted wedge-shaped dendrons. The monodisperse polypeptides were expressed in *E. coli* from synthetic genes encoding polyglutamic acids glu_n with three discrete lengths $n = 58, 76, 94$. Wedge-shaped poly(benzyl-ether) dendrons of three different generations were then grafted to the carboxylic acid side-chains along the peptide backbone. The length of the DPPs is determined by the polypeptide backbone, and thickness is controlled by the generation and chemical structure of the dendritic shell. The DPPs are soluble and form self-assembled LC phases in many organic solvents, including m-cresol. We have observed chiral nematic, smectic, and hexagonal columnar phases in concentrated DPP/m-cresol solutions. Using small-angle X-ray diffraction we have established that the periodicities of the observed LC phases are controlled by dimensions and concentrations of the DPPs. Thus, modular biosynthetic strategy can be used to prepare polymers with well defined molecular shapes and to control formation of well-defined liquid crystalline self-assemblies.