Selective Crystallization of Molecules on Solid Surfaces Using Engineered Self-Assembled Monolayers as Templates

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ABSTRACT

This research is a joint collaboration between the Department of Chemical Engineering at the City College and the Central Research and Development Division of DuPont. The objective of the research is to design solid surface nanotemplates for the heterogeneous crystallization as seeds of one form of a crystalline material which can exist in several polymorphic forms. These polymorph specific seeds are then used to control the selective crystallization in a bulk industrial crystallizer. The approach employs using self assembled silane or organosulfur monolayers which covalently link to solid supports to functionalize surfaces with chemical moities. The moities are selected in such a way that the surface mimics a crystalline face of the desired polymorph. In this way this face nulceates on the surface, and the mature crystal of the desired polymorph grows. Two systems will be studied, the inorganic polymorphs calcite and vaterite of calcium carbonate, and the alpha and gamma forms of the amino acid glycine. In each of these systems, templates will be constructed for selective crystallization. The research addresses Dupont's requirements for selective polymorphic crystallization in their drug and agrochemical industries, and academically contributes to the development of molecular engineering designs for tailoring of surfaces. The engineered nanotemplates developed under this research effort, will be utilized in the design, construction, and testing at DuPont of a device to fabricate seeds. This research effort therefore represents a directed use of nanostructures.