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Main Subjects	1. Solid-state polymerization of conjugated compounds 2. Ionic dye crystals for second-order nonlinear optics 3. Reactions of organic nanocrystals

Content

Solid-state polymerization is a unique polymerization reaction because the reaction is often controlled by the monomer crystalline lattice resulting in polymers with stereo-regular structures. No solvent is required and the reaction conditions are environmental friendly. These merits should be applied for synthesis of functional polymers. In this connection, we have been investigated solid-state polymerization of acetylene and olefin derivatives. Main target compounds are conjugate acetylene compounds to give polydiacetylene derivatives, which are promising materials for photonics such as third-order nonlinear optics. In order to improve the optical properties, molecular designs for both high solid-state polymerizability and extended π-conjugation are being investigated.

We are also investigating reactions of butadiyne nanocrystals. Since molecular weight is controlled by the crystal length along the polymerization direction in solid-state polymerization, preparation of size-controlled nanocrystals are an interesting issue. In addition, we are interested in end modification of polydiacetylene derivatives. We found that solid-state polymerization of butadiyne nanocrystals could be stimulated by using radical initiators. This indicates that polymer ends can be modified by functional groups, and it seems to be useful for orientational control of nanocrystals etc.

Ionic dye crystals such as donor-substituted stilbazoliums have been synthesized for second-order nonlinear optics. Such π-conjugated aromatic dyes have several advantages as organic nonlinear optical crystals like large first hyperpolarizability, crystal structure controllability, and high mechanical and thermal properties. One of the applications is terahertz-wave generation using optical rectification or difference frequency generation. Molecular designs satisfying both optical property enhancement and crystal growing ability are being investigated.