Development for a Rapid and Selective Synthesis of Plastic Raw Materials by Supercritical CO_2 Fixation

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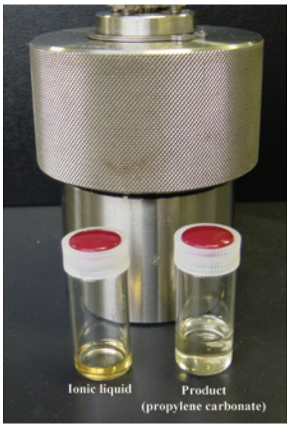
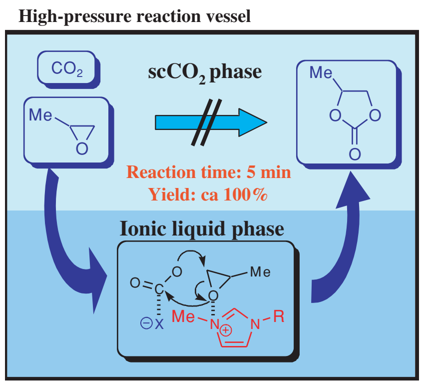
Cyclic carbonate is an important raw material for engineering plastics such as polycarbonate, which can be synthesized from carbon dioxide in the presence of various catalysts. However, the carbonate synthesis using conventional carbon dioxide fixation method is under development and only produces a yield of around 50% at best, even at reaction temperatures of 150 – 200 ºC and with reaction times of 4 – 24 hours. We devised a two-phase system comprising supercritical CO_2 + ionic liquid as a new reaction system for selective and rapid cyclic carbonate synthesis with the potential for practical application, produced 100% yields and 100% selectivity even at a reaction temperature of 100 ºC and reaction time within 5 minutes. This development is expected to significantly accelerate the production methods for more environmentally friendly engineering plastics, and should pave the way for practical application of this technique.





The rapid and selective synthesis of propylene carbonate by CO_2 fixation using $scCO_2$ + ionic liquid two-phase reaction system

Design of Self-Organizing Functional Molecular System

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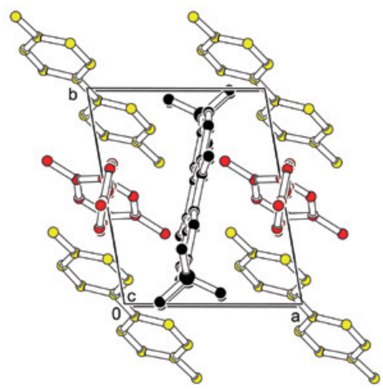
Many scientists focus on constructing functional molecular systems utilizing self-organization of molecules, because the method is economical and works with high (molecular level) accuracy. Here, we report our recent works on the self-organizing molecular systems utilizing electrostatic and donor–acceptor interactions as the driving force for organization. Unique crystal structures containing two kinds of crossed charge-transfer columns are demonstrated by cocrystals consisting of ion pairs of acceptors of methyl viologen anthraquinone disulfonates and a donor, hydroquinone.



Structure of cocrystal of dimethylviologen 2,6-anthraquinonedisulfonate and hydroquinone