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## **Chemical Fixation of Carbon Dioxide: Synthesis of Cyclic Carbonate, Dimethyl Carbonate, Cyclic Urea and Cyclic Urethane**

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Chemical fixation of carbon dioxide (CO<sub>2</sub>) may be very important in the future as a solution for the problem of increased atmospheric CO<sub>2</sub> levels. Recent developments for chemical fixation of CO<sub>2</sub> to cyclic carbonate, dimethyl carbonate (DMC), cyclic urea and cyclic urethane are reviewed. Synthesis of cyclic carbonate *via* CO<sub>2</sub> addition to epoxide has been already applied on the industrial scale, but catalyst development continues. Direct oxidative carboxylation of olefin is preferable for the synthesis of cyclic carbonate, but requires the development of catalysts for the epoxidation step in the presence of CO<sub>2</sub>.

Direct synthesis of DMC is not in practical use at present because of the reaction equilibrium and chemical inertness of CO<sub>2</sub>. The preferred alternative is transesterification of ethylene carbonate and methanol for converting CO<sub>2</sub> to DMC indirectly. Moreover, combination of this reaction with CO<sub>2</sub> addition to epoxide or reaction of ethylene glycol and urea to synthesize DMC is promising. Application of these ideas depends on the development and optimization of catalysts and reaction conditions. Synthesis of cyclic urea and urethane without catalyst should use either CO<sub>2</sub> or urea depending on the structures of diamine and amino alcohol.

**Keywords:** [Carbon dioxide](#), [Chemical fixation](#), [Heterocyclic compound](#), [Cycloaddition](#), [Carbonate](#), [Transesterification](#)

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