The abstract of doctoral dissertation

„Studies on the use of carbon dioxide in the synthesis of cyclic alkylene carbonates over catalyst systems consisting of quaternary ammonium salts”

Author: mgr inż. Katarzyny Jasiak-Jaroń
Supervisor: prof. dr hab. inż. Stefan Baj
Auxiliary supervisor: dr inż. Agnieszka Siewniak

Carbon dioxide is a cheap, abundant, and readily available C₁ source for chemical synthesis. There are known a dozen or so of chemical reactions in which CO₂ is one of raw materials having potential technological significance. Among these reactions the synthesis of cyclic carbonates is an interesting one. The process has an industrial importance because of the wide range of applications of the reaction products. Cyclic carbonates, in particular ethylene and propylene carbonates, are used as plasticizers, polar aprotic solvents, or as ingredients in the pharmaceutical and cosmetic industry.

Currently, cyclic carbonates are obtained on industrial scale in the reaction of carbon dioxide with epoxides. These compounds can also be synthesized through the reaction between CO₂ and olefins. The key challenge for the synthesis of cyclic carbonates from CO₂ is to find catalysts of high catalytic activity, which can be easily separated from post-reaction mixture.

In the doctoral thesis, five new, efficient catalyst systems were developed. These systems were based on ionic liquids or catalysts immobilized on carbon nanotubes and polymer supports. The advantages of cyclic carbonate synthesis using catalyst systems proposed by me, are: mild conditions, high product yield and selectivity, the ability of effective recycle of the catalyst. Moreover, the studies showed, that catalysts based on quaternary ammonium salts immobilized on carbon nanotubes and polymer supports can also be successfully used in the synthesis of carbamates from CO₂.