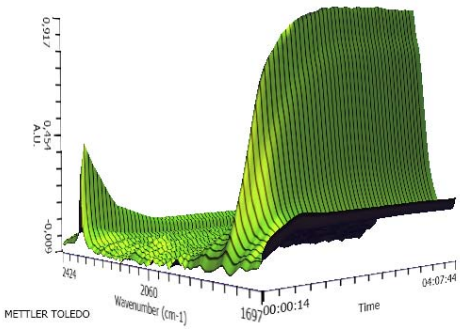
Coupling of carbon dioxide and epoxide via chromium (III), iron(III), cobalt(III), and iron(II) /Lewis base catalysts

Adnan S. Abu-Surrah

Hashemite University, Department of Chemistry, P.O. Box 150459, Zarqa- 13115, Jordan,
E-mail: asurrah@hu.edu.jo

Catalytic coupling of CO_2 with heterocycles has received considerable attention over the past years [1,2]. A majority of these publications involve the reaction of CO_2 with epoxides to generate polycarbonates and/or cyclic carbonates (1,3-dioxolan-2-ones). Numerous number of catalytic systems have been developed for the synthesis of cyclic carbonates, among these catalysts, salen complexes of different transition metals [3]. Nevertheless, only minor studies about the utilization of iron based catalysts for the coupling reaction of epoxide and carbon dioxide have been reported [4].

In the present work, a series of Cr(III), Co(III)-, and Fe(III)-based complexes of the general formula $[(N\cap O)_2MCl]$ (N∩O: N-salicylidene(X)amine, X = 1-naphthyl and cyclohexyl) have been applied successfully as catalysts for the coupling reaction of carbon dioxide and styrene epoxide in the presence of tetrabutyl ammonium bromide (Bu_4NBr) as a co-catalyst. In addition, new iron(II) complexes containing the ligands, N´-(thiophene-2-methylene)benzene-1,2-diamine and N´-(quinoline-2-methylene)benzene-1,2-diamine were utilized for the catalytic reaction.



The catalyst systems showed to be selective in the coupling reaction of CO_2 and styrene oxide, resulting in cyclic styrene carbonate. In general, the iron(III) and cobalt(III) based catalysts bearing the aromatic naphthyl terminal groups showed the highest catalytic activity under similar reaction conditions. Surprisingly, the iron(II) complex with the thiophene donor ligand showed comparable catalytic activity with the Cr(III) based catalysts.

References

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