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Electrochemical Coordination Polymers of Copper(II) Synthesis by Using Rigid and Felexible Ligands

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Abstract : The chemistry of coordination polymers in recent years has grown exponentially not only because of their interesting architectures but also due to their various technical applications in many fields including ion exchange, chemical catalysis, small molecule separations, and drug release. The use of bridging ligands for the controlled self-assembly of one, two or three dimensional metallo-supramolecular species is the subject of serious study in last decade. Numerous different synthetic methods have been offered for the preparation of coordination polymers such as (a) diffusion from the gas phase, (b) slow diffusion of the reactants into a polymeric matrix, (c) evaporation of the solvent at ambient or reduced temperatures, (d) temperature controlled cooling, (e) precipitation or recrystallisation from a mixture of solvents and (f) hydrothermal synthesis. The electrosynthetic process suggested several advantages over conventional approaches. A general advantage of electrochemical synthesis is that it allows synthesis under milder conditions than typical solvothermal or microwave synthesis. In this work we have introduced a simple electrochemical method for growing metal coordination polymers based on copper with a flexible 2,2'-thiodiacetic acid (TDA) and rigid 1,2,4,5-benzenetetracarboxylate (BTC) ligands. The structure of coordination polymers were characterized by scanning electron microscopy (SEM), X-ray powder diffraction (XRD), elemental analysis, thermal gravimetric (TG) and differential thermal analyses (DTA). The single-crystal X-ray diffraction analysis revealed that different conformations of the ligands and different coordination modes of the carboxylate group as well as different coordination geometries of the copper atoms. Electrochemical synthesis of coordination polymers has different advantages such as faster synthesis at lower temperature in compare with conventional chemical methods and crystallization of desired materials in a single synthetic step.

Keywords : 1,2,4,5-benzenetetracarboxylate, coordination polymer, copper, 2,2'-thiodiacetic acid
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