Electrochemical Synthesis and Fabrication of Metal-Organic Framework Polymorphs Based on Tl(TCNQ)

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Abstract

The synthesis and fabrication of nanostructured materials having fascinating optical, electrical, and magnetic properties is essential motive for developing new of new-generation of electronic and memory devices. TCNQ-based molecular materials have been implemented in such applications, and in recent years considerable efforts have been directed towards the design and fabrication of tunable nanoscale materials. In this presentation, facile electrochemical approaches for the synthesis, characterization, and fabrication of morphology-tunable semiconducting/insulating Tl(TCNQ) nanostructures onto conducting (Pt, Au, GC) and semiconducting (ITO) electrode surfaces will be discussed. These approaches involve solid-solid phase transformations of TCNQ microcrystals, attached to an electrode surface, into the corresponding Tl(TCNQ) when immersed in an aqueous solution of $Tl^{+}_{(aq)}$ electrolytes, and subjected to one-electron reduction to form the $TCNQ^{-}$ radical. The overall TCNQ/Tl(TCNQ) conversion process requires the transfer of one-electron at the triple phase, electrode| $TCNQ/TCNQ^{-}|Tl^{+}_{(aq)}$ junction, with a nucleation-growth rate-determining step. Characterization of the electrochemically generated Tl(TCNQ) based materials via wide range of spectroscopic (IR, Raman), microscopic (optical, SEM, EDAX), as well as conventional and synchrotron-based XRD techniques will be highlighted. Compare to other synthetic methods, this electrochemical approach provides an easy access for tuning the morphology and crystals size of Tl(TCNQ) materials as well as facile fabrication onto conducting and semiconducting substrates to suit the desired applications.

References

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