

## Abstract

Hollow microstructures of cryptomelane-type manganese oxide were produced in a template-free one-step process based on the fine-tuning of the oxidation rate of manganese species during the synthesis. The tuning of the reaction rate brought about by a mixture of the oxidants oxone and potassium nitrate becomes apparent from the gradual physical changes taking place in the reaction medium at early times of the synthesis. The successful synthesis of the hollow uniform structures could be performed in the ranges 120-160 degrees C and 8.2-10.7 for temperature and mass ratio oxone/potassium nitrate, respectively. Independent of the conditions of the synthesis, all of the complex microstructures showed the same pattern for the array of very long nanofibers in which some of these elongated around the surface confining the cavity and the other fibers grew normal to the surface created by the previous arrangement. A mechanism based on the heterogeneous nucleation of the cryptomelane phase on the surface of an amorphous precursor and the growth of the nanoscale fibers by processes such as dissolution-crystallization and lateral attachment of primary nanocrystalline fibers is proposed to explain the formation of the hollow structures.