Coalescence inhibition of hydrous RuO_2 crystallites prepared by a hydrothermal method

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Coalescence of particulates accompanied with crystal growth upon annealing at or above 200°C, found for hydrous RuO_2 ($RuO_2 \cdot nH_2O$) prepared by a sol-gel process, is effectively inhibited by the formation of $RuO_2 \cdot nH_2O$ nanocrystallites in a hydrothermal process. This thermal stability, attributable to the barrier originated from the lattice energy of crystallites, maintains the high water content, nanocrystalline structure, and porous nature of $RuO_2 \cdot nH_2O$ annealed at elevated temperatures from 200 to 400°C. A hydrothermal derived RuO_2-based supercapacitor with high specific capacitance (ca. 200 F g^{-1} measured at 100 mA cm^{-2}) and a cycle-life time longer than 40000 cycles, resulting from thermal stability, is demonstrated.

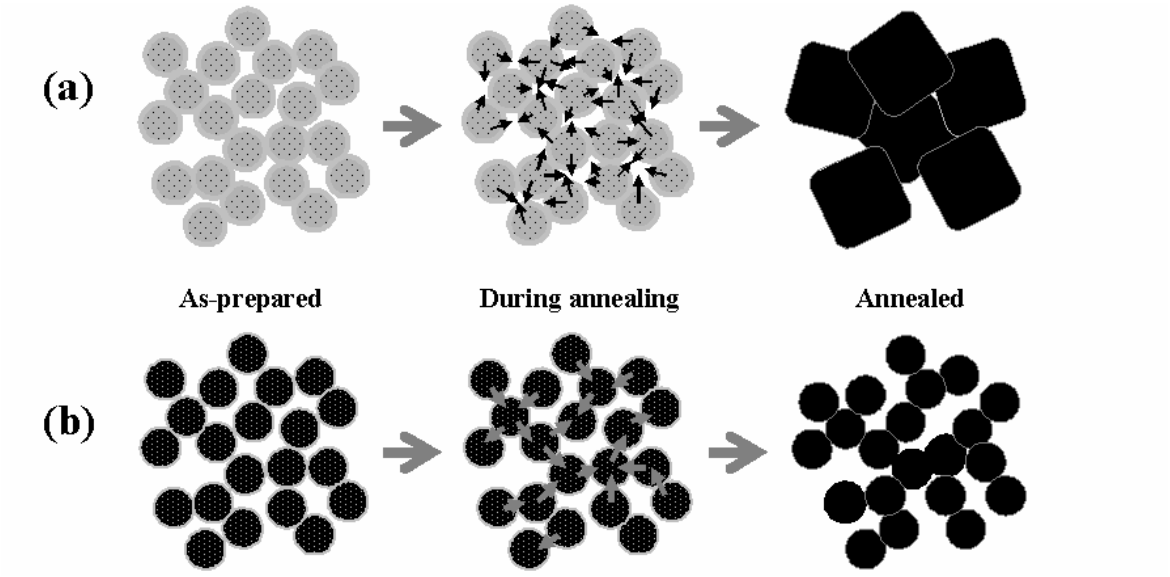

Fig.1 A schematic model of the microstructure variation upon annealing for (a) amorphous and (b) crystalline $RuO_2 \cdot nH_2O$.

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