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Mechanism of copper oxide nanostructured particles synthesized using silk fibroin template

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In this study, various mesoporous Copper Oxide (CuO) nanostructured particles were synthesized by a simple wet chemical process using Silk Fibroin (SF) template. CuO nanoparticles were prepared with cupric acetate monohydrate, various amounts of 1 wt% SF aqueous solution, sodium dodecyl sulfate as a surfactant and distilled water as a solvent in alkali condition at 60 °C. The structural characterization of the nanoparticles was performed. The control of the amount of SF molecules in precursor solution could induce a change of morphological structure of the CuO/SF nanostructured particle. The formation of free $Cu(OH)_4^{2-}$ may be interrupted by the SF and a $Cu(OH)_4^{2-}$-SF complex is formed through coordination bonds between $Cu(OH)_4^{2-}$ ion and SF molecules. The development of a complex with SF can make $Cu(OH)_4^{2-}$ more stable without a drastic transformation into CuO. In the structural formation of CuO nanoparticles, crystal growth mainly occurred in the direction of the (010) lattice plain during condensation, in which $Cu(OH)_4^{2-}$ transformed into CuO. With an increase in the amount of SF, there were fewer free OH- ions due to interactions with SF molecules, which adsorbed preferentially on the (001) plane of CuO nanocrystals, resulting in assemblages not only on the (010) plane, but also on the (100) plane. Therefore, the SF plays multiple roles on monoclinic CuO nanostructure formation, such as stabilizing the $Cu(OH)4^{2-}$ ions without a drastic transformation to CuO nanocrystal and directing the oriented crystal growth of CuO nanocrystal.

Biography

Jong Wook Kim has received his PhD in Fiber and Polymer Science program from North Carolina State University, North Carolina, USA. He is a Professor of Seoul National University, Seoul, Republic of Korea in the Department of Bio-systems and Biomaterials Science and Engineering. He has published more than 100 papers in SCI journals and about 20 patents in the field of silk-based biomaterials.

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