

Reductant-Free Synthesis of Silver Nanoparticles by Functionalized Hollow Doughnut Mesoporous Silica Nanoparticles for Preparation of Catalytic Nanoreactor

Vo Tri Nhat, 김덕준[†]
성균관대학교
(djkim@skku.edu[†])

This work reports investigation about functionalization of hollow doughnut mesoporous silica nanoparticles (hd-MSN) by N1-(3-Trimethoxysilylpropyl) diethylenetriamine (DAEAPTS). We experimentally show that the tri-amino functional groups on hd-MSN (hd-MSN-NH₂) act as capping agent as well as reducing agent for silver ions and the reduction reaction process can significantly influence the structure of the silver nanocrystals. Thus, we have deposited uniform 4.2 nm silver nanocrystals on the hd-MSN-NH₂ nanoparticles without any reducing agents. The mechanism of reduction of Ag⁺ ion was clearly studied by FT-IR, FT-Raman, XRD and XPS studies. Ag/hd-MSN-NH₂ with special shape (hollow doughnut shape) could incorporate Ag NPs both inside and outside of hd-MSN. Here Ag/hd-MSN-NH₂ worked as nanoreactor. In our condition for catalytic reduction of 4-nitrophenol, the reaction rate reached 4.1 x10⁻³ s⁻¹ which is higher than many previous results. The Ag/hd-MSN-NH₂ nanocatalyst shows excellent reusability and high efficiency even after 10 cycles.