

Using Gelatin as Protecting Agent and Organic Template to Synthesize Noble Metal Nanoparticles and Metal Nanoparticles@Mesoporous Silica for SERS and CO Oxidation Applications

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With excellent control of their synthetic compositions and condition, noble metal nanoparticles@mesoporous silicas of large surface area ($\approx 300 \text{ m}^2\text{g}^{-1}$), large pore size ($> 5.0 \text{ nm}$), and high noble metal nanoparticle content ($\approx 10 \text{ wt.}\%$) have been conveniently prepared using natural polymer gelatin with many amide ($-\text{CO}-\text{NH}_2$) groups as an organic template of mesoporous silica and a protecting agent for stabilizing Au nanoparticles. This synthetic method is extensive and can be used to prepare Au, Ag, and Ag-Au alloy nanoparticles@mesoporous silicas. Because the metal nanoparticles are accessible to the environment, noble-metal nanoparticles@mesoporous silicas can be used in SERS applications and act as superior catalysts in CO oxidation at high temperatures. In addition, bare Au nanoparticles anchored on a silica matrix can have direct contact with *S. aureus* cells to enhance the Raman spectrum intensity of *S. aureus* cells absorbed onto a Au nanoparticles@mesoporous silica.

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