

X-ray Absorption of Nanocrystal PEG Coated Ag and Gold Nanoparticles

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Recently, we developed a x-ray irradiation method to prepare pegylated silver and gold nanoparticles in aqueous solutions. This method is based on bombardment by a synchrotron-emitted beam of X-rays of a mixed precursor solution: the irradiation was found to stimulate the formation of nanoparticle coated by PEG. Its additional advantages include: (1) a simple one-pot procedure to achieve pegylation; (2) cleanliness (the system is free of pre-added reducing agents and surfactant); (3) room temperature operation; (4) capable to scale up for mass production and with super reproducibility; (5) capable to achieve high concentration without compromising re-dispersion and high stability; (6) using only PEG molecules instead of more expensive PEG-thiol. The objective of the XAFS studies described here is to characterize the metallic nanoparticles prepared by this novel method.

Figs.1 and 2 show Ag L_2 and Au L_3 K absorption spectra of PEG coated Ag and Au nanoparticles prepared by synchrotron X-ray irradiations. From these two figures, we can conclude: (1) zero-valence Ag nanoparticles were formed as verified by comparing the spectrum of PEG-gold with either the Ag precursor (AgNO_3) or Ag foils. The broadening of the fine structures of nanoparticles (relevant to Ag foil) could be attributed to the quantum size effects (2) in the length scale of 5 and 15 nm (corresponding to PEG-gold and unmodified gold), there is little difference in the electronic structure of colloidal gold particles. In addition, the data of XAFS of colloidal Ag and Au in this study indicated PEG coating also not affect the local atomic structure of colloidal particles. On the other hand, the effect of enclosed gold nanoparticles on the XAFS characteristics of PEG molecules were also investigated by soft X-ray absorption at BL20A. coating,are respectively. The data at K-edges of C and O

also indicated no significant effect of metallic core on PEG molecules.

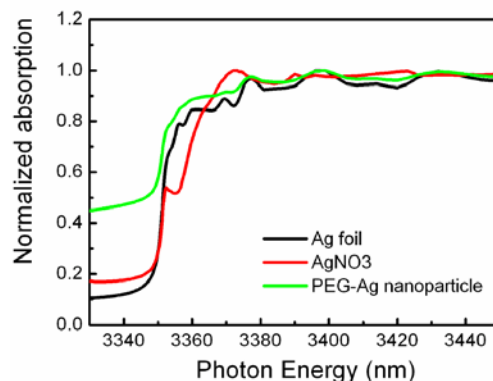


Figure 1. Ag L_2 -edge absorption spectra of Ag precursor, Ag nanoparticle and Ag foils.

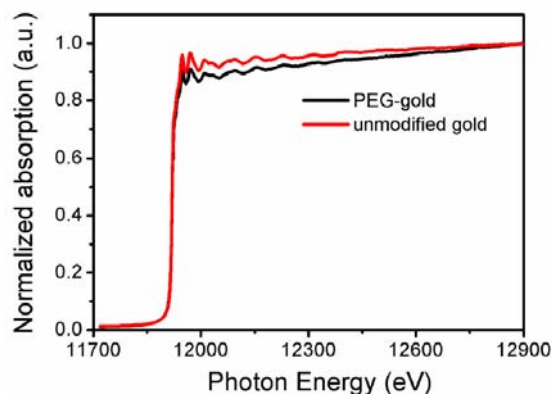


Figure 2. Au L_3 absorption spectra of PEG-gold and unmodified gold nanoparticles.