Optical luminescence from protein-directed Au~20 clusters upon hard X-ray irradiation

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Keywords: Hard X-ray irradiation; Protein; Au clusters; Luminescence

Hard X-ray excited optical luminescence (hXEOL) is promising in bio-imaging field, but development of contrast agents is limited. Previously, we used protein-directed Au_{25} clusters as the contrast agent for hXEOL.[1] Recently, protein-directed $Au_{\sim 20}$ clusters were found to have higher emission quantum yield (15%) than Au_{25} clusters (4%).[2] In this study, we employed protein-directed $Au_{\sim 20}$ clusters as the contrast agent and investigated their luminescent properties under hard X-ray irradiation (60 kVp), both in solutions and films.[3]

Three kinds of proteins were used for the synthesis of $Au_{\sim 20}$ clusters, namely, bovine serum albumin (BSA), human serum albumin (HSA) and lactoferrin. Upon hard X-ray irradiation, clear emission was observed from the solutions of protein-directed $Au_{\sim 20}$ clusters (Fig. 1a and 1b). When embedded in films (PEG/PVA), we observed red emission from HSA-directed $Au_{\sim 20}$ clusters under UV light irradiation (Fig. 1c). Furthermore, the HSA-directed $Au_{\sim 20}$ clusters in the films displayed clear emission under hard X-ray irradiation compared to the control films (Fig. 1d). These results demonstrated potential application of protein-directed $Au_{\sim 20}$ clusters in bio-imaging field.

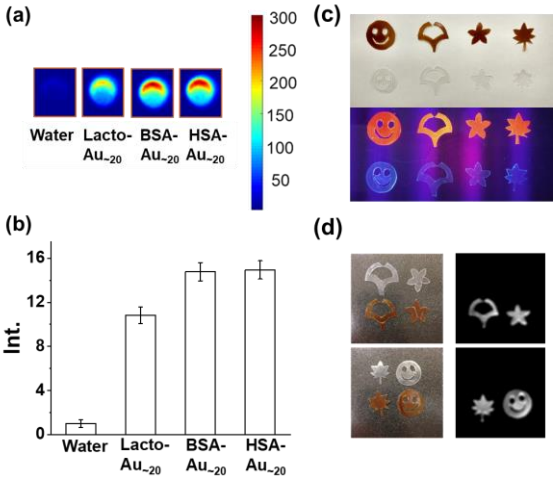

Figure 1. (a) hXEOL images and (b) signal of water, lactoferrin-, BSA- and HSA-directed $Au_{\sim 20}$ clusters. (c) Images of HSA-directed $Au_{\sim 20}$ clusters embedded films and control films under natural light (top) and UV light (365 nm, bottom) irradiation. (d) Images of HSA-directed $Au_{\sim 20}$ clusters embedded films and control films under natural light (left) and hard X-ray irradiation (right).

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