Functionalization of Polyethylene Terephthalate Fabrics with Au@Cu_2O Core@Shell Nanocrystals for Environmental Purifications

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With the rapid development of our society and economy, water pollution by synthetic dyes has become a major concern due to its direct impact on human health and ecological environment. Several mitigation techniques, such as adsorption, flocculation, coagulation, and sedimentation, have been utilized to treat dye-contained wastewater. However, these techniques may result in secondary contamination and are not capable to completely remove the dye molecules.

As an alternative technique, photocatalysis has shown promising potentials to address water pollution because it can achieve complete dye degradation with a high efficiency. As Figure 1 shows, Au@Cu_2O core@shell nanocrystals with controllable shell thicknesses have been prepared and immobilized on polyethylene terephthalate (PET fabrics for applications in photocatalytic degradation of methylene orange (MO). Figure 1(j) shows Au@Cu_2O with an optimal shell thickness that can provide PET fabrics with the highest photocatalytic activity toward MO degradation. Recycling tests shown in Figure 1(k) revealed a sustained photocatalytic activity during repeated usages, which highlights the structural robustness and chemical integrity of the Au@Cu_2O-functionalized PET. Scavenger experiments shown in Figure 1(l) were further conducted to explore the reactive species responsible for the MO degradation on Au@Cu_2O-functionalized PET. Both h^+ and $\cdot O_2^-$ played a dominant role in the degradation process of MO.

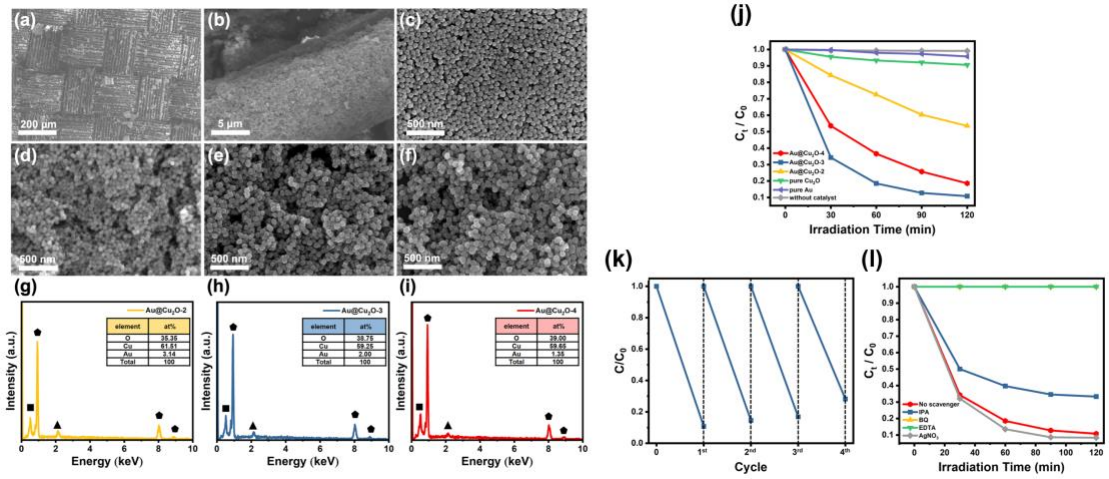

Figure 1. SEM images for (a-b) Au@Cu_2O-functionalzied PET fabrics, (c) pure Cu_2O, (d) Au@Cu_2O-4, (e) Au@Cu_2O-3, (f) Au@Cu_2O-2. (g-i) Corresponding EDS spectra (■: O, ⬟: Cu, ▲: Au), (j) MO degradation result, (k) Recycling tests on Au@Cu_2O-3-functionalized PET, and (l) scavenger experiments on Au@Cu_2O-3-functionalized PET.