**One-step deposition of copper/cuprous copper oxide core-shell nanocrystals on highly conductive graphene sheet electrode**

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**Introduction**

Flexible conductive graphene is an excellent electrode material for versatile applications in the field of nanomaterials. Electrodeposition is an easy and inexpensive method that can be used to prepare metallic nanocrystals by simply varying the deposition conditions.

**Method**

Electrodeposition has been used to prepare all the nanocrystals. Scanning electron microscopy (SEM) has been used to measure the crystal sizes. A combination of the Glancing Incidence X-ray Diffraction (GIXRD), Transmission Electron Microscopy (TEM) and X-ray Photoelectron Spectroscopy (XPS) depth profile have been used to analyse the nanocrystal composition.

**Results and Discussion**

By controlling the potentials of the electrodeposition, sub-100 nm sized copper/cuprous copper oxide nanocrystals with a unique core-shell structure can be effectively produced onto graphene electrode. By analysing their current-time transient profiles, a conventional nucleation formation step is found at the early stage of the deposition which leads to a metallic copper core; large deviation from the modelled current is found after the initial nucleation and an additional current is added to the total deposition current, likely associated with the cuprous copper shell formation. GIXRD, TEM and XPS results show that different deposition potentials alter not only the deposited nanocrystal sizes and shapes but also the chemical compositions of core-shell nanocrystals.

**Conclusions**

Core-shell structured copper/cuprous copper oxide nanocrystals were successfully prepared on graphene sheet electrodes using an ease electrodeposition method. This study provides insights on the deposition mechanisms and the nanocrystal structural and chemical information, which is crucial for its applications in chemical or biosensing.

**Keyword**

Graphene electrode, Copper/cuprous copper oxide nanocrystals.

**References**

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