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Recently graphene, a two-dimensional carbon material has been attracted tremendous attention and research interest owing to its fascinating properties [1]. The excellent properties as well as large surface area, chemical stability and low cost, make the graphene as a potential partner for hybrids. To date, several surface modified graphene-based hybrids have been produced with inorganic nanostructures, organic crystals, polymers, metal-organic frameworks, biomaterials and are greatly stimulated due to their promising properties in diverse applications ranging from batteries [2], supercapacitors [3], fuel cells [4], photovoltaic devices [5], etc. Graphene related materials like graphene oxide (GO), reduced graphene oxide and metal decorated graphenes are ideal candidates for incorporation into a variety of functional materials. Recently in particular, research on gold nanocrystal-reduced graphene oxide (AuNC-RGO) hybrids is centered [6-8].

A facile soft solution processing was presented for the synthesis of AuNC-RGO hybrids via reduction of chloroauric acid by employing trisodium citrate (TSC) and sodium borohydride. A rapid systematic study on concentration-driven (chloroauric acid), size-controlled synthesis of AuNCs on the surface of RGO sheet have been evaluated. The resulted AuNC-RGO(1), AuNC-RGO(3) hybrids are contaminated with gold nanowire networks (GNWNWs) or gold agglomerates (GAMs) respectively. However in the case of AuNC-RGO(2) hybrid, 2-6 nm size AuNCs are uniformly decorated on the surface of RGO sheet and have no contaminants. This hybrid was fully characterized by transmission electron microscopy, UV-visible spectroscopy, X-Ray photoelectron spectroscopy, Raman spectroscopy, X-ray diffraction. A novel “charged complex cluster model” is proposed for the AuNCs formation based on our experimental (time-dependent potentiometric and UV-vis spectroscopy) and literature evidence. We hope that proposed model is more reasonable for understanding the nucleation and growth processes. Further experiments for supporting the proposed model is under progress.

Development of graphene hybrid materials and evaluation of nucleation-growth processes of AuNCs formation will be useful for various technological applications.

References: