Extinction Coefficients of the Monodisperse, Ultra-smooth, and Highly Spherical Gold Nanoparticles

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The theoretical extinction coefficients of gold nanoparticles (AuNPs) have been mainly verified by analytical solving Maxwell equation for an ideal sphere, which was firstly founded by Mie (generally referred to as Mie theory). However, in principle, it hasn't been directly feasible with the experimental verification especially for the relatively large AuNPs (i.e., > 40 nm), as conventionally proposed synthetic methods have inevitably resulted in the polygonal shaped, non-ideal Au nanosphere. Here, the mono-crystalline, ultra-smooth, and highly spherical AuNPs of 40 nm−100 nm were prepared by the procedure reported in our recent work (ACS Nano 2013, 7, 11064). The extinction coefficients of the ideally spherical AuNPs of 40−100 nm were empirically extracted using Beer-Lambert laws, which were then compared with theoretical limits obtained by analytical and numerical methods. The emperically obtained extinction coefficients of the ideally spherical AuNPs herein are found to agree much more cloesely with the theoretical limits, compared with those of the faceted or polygonal shaped AuNPs.