Cationic Gold Nanoparticles for Chiral Plasmonic Electrostatic Self-Assemblies

Robin. H. A. Ras

Department of Applied Physics, Aalto University, Finland

robin.ras@aalto.fi

Despite major progress on gold nanoparticle (AuNP) research in general, the synthesis of cationic AuNPs larger than 5 nm has remained a major challenge, although these species would give a significantly larger plasmonic response compared to smaller cationic AuNPs. In this work, we present a synthesis method for cationic AuNPs with tunable sizes between 8–20 nm, prepared by a facile two-step phase transfer protocol starting from simple citrate-capped particles (Fig. 1, right).[1] This functionalization method is rapid and straightforward, produces highly stable cationic AuNPs with narrow particle size distribution, and can easily be scaled up.

These cationic particles form ordered self-assembled structures with negatively charged biological components through electrostatic interactions, such as binary crystals of AuNPs and virus particles. Furthermore we will demonstrate that the right-handed twist of aqueous dispersed cellulose nanocrystals allows chiral plasmonics upon electrostatic binding of AuNPs on their surface.[2] A pronounced right-handed circular dichroic signal is achieved in dilute aqueous environment upon tuning of the nanoparticle sizes and optimizing the sample preparation processes (Fig. 1, left).

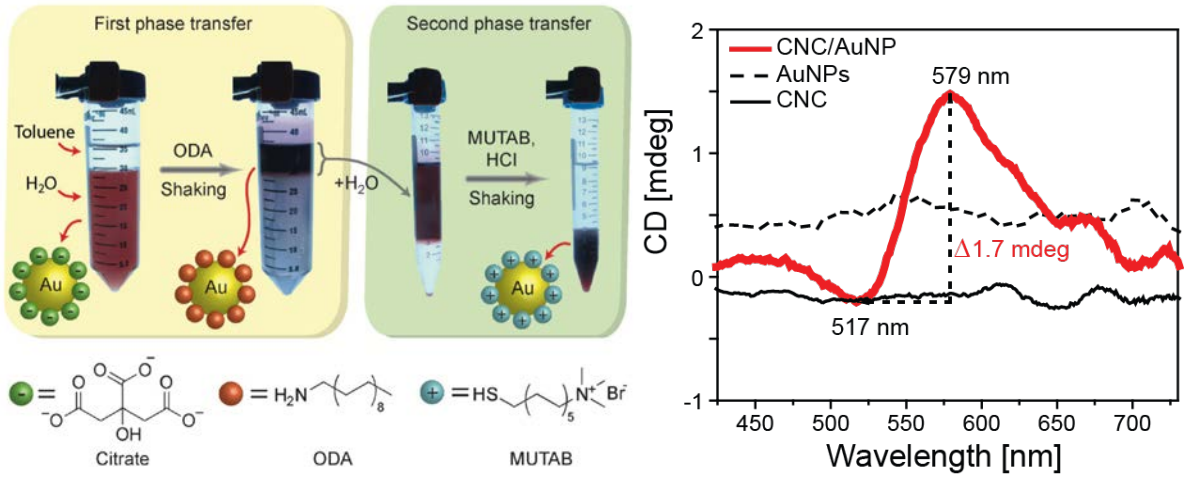

Figure 1: (left) Two-step phase transfer of anionic citrate-AuNPs to cationic MUTAB-AuNPs via neutral ODA-AuNPs. (right) Right-handed circular dichroic signal resulting from electrostatically binding nanoparticles on chirally twisting colloidal nanocellulosic rods.

[1] Hassinen J., Liljeström V., Kostiainen M. A. and Ras R. H. A. Rapid Cationization of Gold Nanoparticles by Two-Step Phase Transfer, *Angew. Chem. Int. Ed.*, **2015**, 54, 7990–7993.

[2] Majoinen J., Hassinen J., Haataja J. S., Rekola H. T., Kontturi E., Kostiainen M. A., Ras R. H. A., Törmä P. and Ikkala O., Chiral plasmonics using twisting along cellulose nanocrystals as a template for gold nanoparticles, *Adv. Mater.*, **2016**, accepted.