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Studying the dependency between ligand and Gold to improve nanoparticle growth

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Gold nanoparticles (AuNP) are widely applied in many different scientific fields like medicine, biology and optics. Especially anisomorphic AuNP like rods (AuNR) are highly versatile and grown out of the liquid phase via a seed mediated growth process aided by a soft template consisting of ligands like CTAB. However, a major problem is the lack of control during the nanoparticle growth due to the highly complex interplay between the different reactants, additives and stabilizing agents. Our focus lies on the study of the soft template and its influence during growth on the AuNR morphology and yield. For that we use a combination of SAXS and SANS. With SAXS we can determine all properties concerning the AuNP. SANS on the other hand is in our experience a very reliable method to observe the soft template in its naturally occurring state under different conditions. We found, that despite the widely cited theory of a closed surfactant bilayer stabilizing AuNPs, the surfactant micelles play a major role during the AuNP growth. By tuning the morphology of micelles, via the addition of different additives, we could guide AuNR growth. We directly correlated an increased micelle length, with increased colloidal stability, in the case of the seed particles, and decreased aspect ratios for AuNR. Future work will expand on that research to find a consistent stabilization model, which includes the micelles as a major factor, to find new pathways for an improved control over the synthesis.

Primary author: Mr ZECH, Tobias (Institute for Crystallography and Structural Physics, FAU Erlangen-Nürnberg)

Presenter: Mr ZECH, Tobias (Institute for Crystallography and Structural Physics, FAU Erlangen-Nürnberg)

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