Surface chemistry of PEGylated gold nanoparticles

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PEGylation is an established method to improve the pharmacokinetic properties of nanomaterials. In the case of gold nanoparticles (AuNP), PEG-thiols are commonly used because they bind to the gold surface strongly.
Tailoring the molecular structure of the PEG-ligand can greatly affect the properties of the PEGylated AuNP. E.g., we have shown that the chemical stability can be enhanced dramatically by using suitable molecular structures near the binding thiol group.[1] In this contribution, recent work on the advanced PEGylation of AuNP and gold nanorods will be presented. The focus will be the PEGylation of AuNR with very high grafting densities[2] and the precise control of mixed ligand layers on AuNP (Fig. 1).[3]

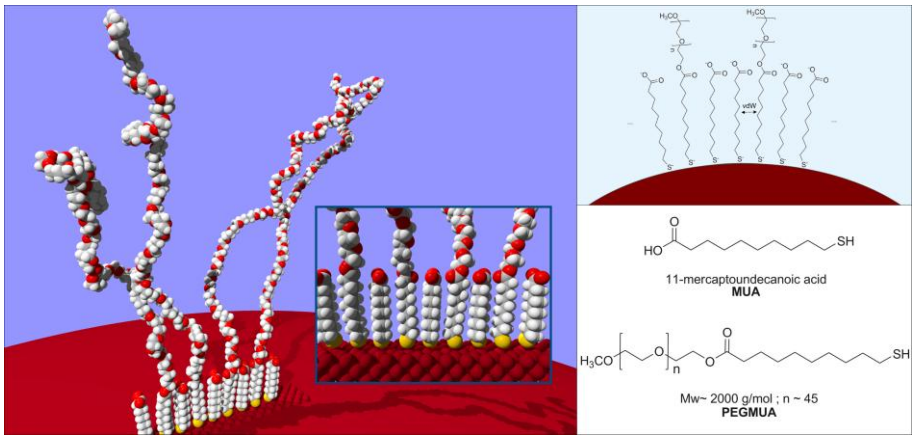

Fig. 1 Illustration of a mixed ligand layer and structures of the constituents.

Neither of them can be achieved with PEG-thiols typically employed.[4][5] The ability to reproducibly synthesize AuNP with very low dispersity and high uniformity at large scales[6] and the ability to stabilize AuNP and AuNR efficiently enables new experiments for their advanced characterization. E.g. the response of highly concentrated PEGylated AuNP to pressure was studied *in situ* with small-angle X-ray scattering (SAXS).[7]

Understanding and controlling the surface chemistry of nanoparticles is essential for the prediction of properties, ensuring stability and consequently their safe and reproducible application.

1) F. Schulz *et al.*, *Langmuir* **2013**, *29*, 9897.
2) F. Schulz *et al.*, *Nanoscale* **2016**, *8*, 7296.
3) F. Schulz *et al.*, *Langmuir* **2016**, *32*, 7897.
4) M.J.A. Hore *et al.*, *Nano Lett.* **2015**, *15*, 5730.
5) A.M. Smith *et al.*, *Anal.Chem.* **2015**, *87*, 2771.
6) F. Schulz *et al.*, *Langmuir* **2014**, *30*, 10779.
7) M.A. Schroer *et al.*, *J.Phys.Chem.C* **2016**, *120*, 19856.