**Session** of Focus Materialchemie – Wednesday, **30.10.2024** 16:00 @ Seminarraum Lehar 01 (TU-Wien, Getreidemarkt 9, BC, OG. 01, room A46)
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# Power of plasmonic materials for energy transfer to organic molecules towards sensing and catalysis

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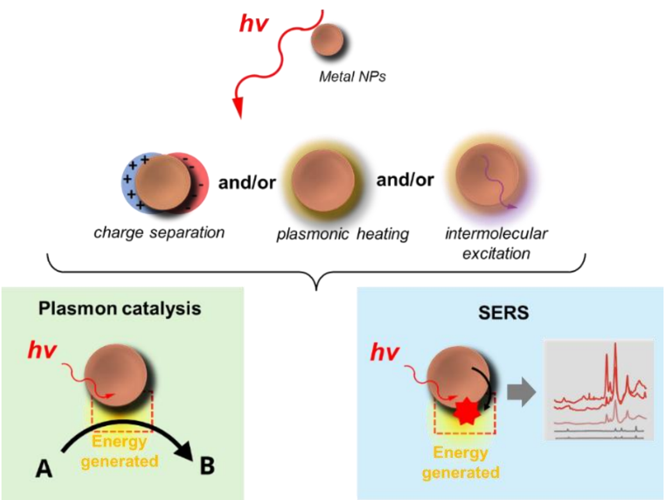
Surface plasmon resonance (SPR) on nanoparticles, excited by light, effectively transfers energy to organic molecules. Surface plasmons (SPs) are collective oscillations of valence electrons, triggered when the incident electromagnetic (EM) field matches the electrons' natural frequency [1]. These plasmon-molecule interactions can (i) enhance surface chemical reactions (plasmon catalysis) [2] and (ii) amplify analytical signals in surface-enhanced Raman spectroscopy (SERS) [3]. SPs create enhanced EM fields, boosting the Raman scattering of nearby molecules [3]. In plasmonic chemistry, EM fields can decay radiatively, exciting molecules, or non-radiatively, generating hot carriers or increasing local temperature [2].This talk will explain the main principles of energy transfer between plasmonic materials and organic molecules using specific examples from works of Dr. Guselnikova. She contributed to the development of advanced SERS for the analysis of complex environmental and biosamples via surface chemistry approach. The surface modification enables to attract the key analytes to the surface and improve sensitivity via preconcentrating effects. This was proved by growth nanoporous MOF layer on mesoporous gold film [4]. Alternatively, plasmonic hierarchical Ag was functionalized with hydrophobic layer for improved attraction of microplastic (MPs) [5]. These additional layer allow selective entrap of pseudoephedrine (in undiluted blood plasma) and MPs (in marine water).




*Plasmons are excited on noble Me NPs and energy transfer leads to the applications in SERS and plasmon catalysis*

Secondly, plasmonic materials could catalyze chemical reactions at room temperature instead of commonly used heating or structurally-complex homogeneous catalysts [6]. The main condition is the use the light with energy close to absorption of plasmonic catalysts for plasmons excitations. There is a scope of organic reactions tested by Dr. Guselnikova: selective hydrogenation of triple bonds [7], degradation [8], $CO_2$ cycloadditions [9], homolysis [10]. The specific examples are use of UiO-66–$NH_2$ as an advanced host platform for the loading of proline and AuNPs. Aldol reactions resulted in 91% *ee* with a closed-to-quantitative yield, 4.5 times higher than that without light [11]. The covalent attachment of superbase to the AuNPs allow to develop ambient condition catalysts for $CO_2$ cycloaddition to carbonates [9]. Finally, the current opportunities and challenges in the field of plasmonic materials applications will be overviewed.

**References:**

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