PORPHYRINS CATALYSTS GRAFTED ONTO PLASMONIC GOLD NANOMATERIALS- FOR CATALYTIC OXIDATION REACTIONS

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Plasmonic material such as plasmonic nanoparticles (NPs) (silver or gold especially) are highly relevant materials for catalysis since they present interesting plasmonic properties under light exposure. The localized surface plasmon (LSP) is a collective oscillation of the free electrons confined inside metallic NPs induced by the interaction with light which generates highly excited electrons. It can have several effects on the local environment such as inducing a local increase of the electromagnetic field (enhanced field) and the temperature (thermoplasmonic effect) or generating hot electrons[1]. Molecular plasmonics is an emerging interdisciplinary field that explores the interaction between plasmonic nanostructures and molecular systems at the nanoscale. This field holds significant promise for applications in catalysis, where plasmonic effects can drive and enhance chemical reactions through localized electromagnetic fields and hot electron generation, enabling novel catalytic pathways[1]. Among the numerous catalytic reactions existing, oxidation reactions are interesting processes and cobalt porphyrins as catalyst have demonstrated to highly perform in oxidative transformations, particularly the functionalization of inert substrates like alkanes and alkenes.[2,3]

The aim of this work is to prepare a metal porphyrin catalyst bearing a thiolated group to be grafted onto plasmonic gold nanostructures. The idea is to combine a traditional molecular catalyst with plasmonic nanomaterial to enhance the rate of the reaction without any heat and provide the plasmon mediated molecular catalyst for the considered oxidation process.

Figure 1. Example of plasmon mediated catalytic epoxidation of cyclooctene
Performed by a cobalt porphyrin grafted onto gold nanoparticles

References

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