# Light-Driven Catalytic Oxidation At The Floating Au–Silica Interface: A Planar Model For Pickering Foams

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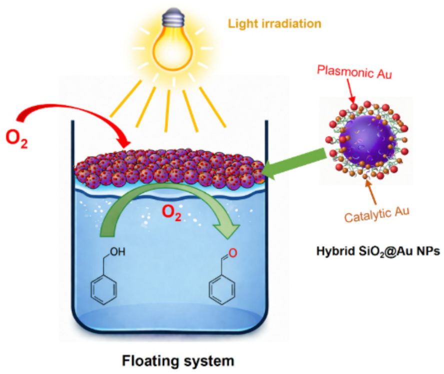
Pickering foams, stabilized by solid nanoparticles, generate a well-defined three-phase environment between air, solid, and liquid – that concentrates catalytic sites within the foam lamellae and promotes efficient mass transfer in multiphase reactions [1]. Exploiting this architecture for catalysis is highly attractive; however, the complex and dynamic nature of real foam systems makes it difficult to precisely characterise and control the active interfacial region.
Gold nanoparticles are particularly appealing in this context, as their tuneable size can combine catalytic activity and plasmonic properties, generating localized heating under light irradiation. Our group previously developed Pickering emulsion systems in which plasmonic Au-loaded amphiphilic silica nanoparticles were co-assembled with catalytic nanoparticles at the water/oil interface, affording a five-fold increase in catalytic activity compared to thermal heating for alkene oxidation [2].
To deepen understanding of the interface encountered in Pickering foam systems, we developed a simplified planar model: a floating catalytic layer composed of self-assembled amphiphilic Au-silica particles at a flat air-liquid interface. This tractable geometry reproduces the essential physicochemical features of the foam lamella. At the interface, Au nanoparticles play a dual role as catalytic centres and plasmonic nano-heaters, while both substrate and oxidant remain readily accessible. Although the macroscopic geometry limits the available interfacial area and catalytic activity compared to emulsion or foam systems, this floating configuration uses air as the sole oxidant and minimzes organic solvent consumption, contributing to a greener process. As such, this system serves as a well-defined model for investigating the interfacial processes that govern catalysis in Pickering foam architectures.

**Keywords:**
Pickering foam, plasmonic nanoparticles, Pickering interfacial catalysis, hybrid particles.




*Light-driven aerobic oxidation at the air–water interface*

**References:**

[1] D. Dedovets, Q. Li, L. Leclercq, V. Nardello-Rataj, J. Leng, S. Zhao, M. Pera-Titus, *Angewandte Chemie International Edition* **2022,** 61.
[2] Y. Feng, J.-F. Dechezelles, Q. D'Acremont, E. Courtade, V. D. Waele, M. Pera-Titus, V. Nardello-Rataj, *Green Chem* . **2023** , 25, 1417.