Title	Non-equilibrium catalytic systems for nanostructured devices

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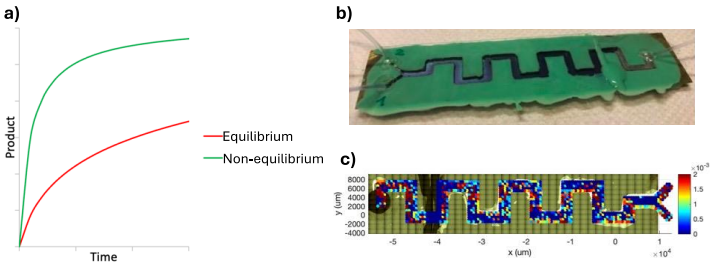
# months (min.3)	3-4 months

Project

Living organisms maintain biochemical systems in a non-equilibrium steady state, by continuously dissipating energy. This approach is crucial for several kye processes, such as movement, sensing, DNA replication and repair, etc. Chemistry, which was mostly focused on processes progressing towards equilibrium, has begun to develop and study synthetic systems that can mimic non-equilibrium biological phenomena.[1]

We are interested in developing catalytic systems with enhanced properties at a non-equilibrium steady state. Light will be used as an energy source to create molecular structures with heightened properties when driven away from equilibrium upon irradiation. These systems will be then supported on nanostructured films and integrated in microfluidic devices.[2] This approach will enhance the catalytic properties, by decreasing the product inhibition of catalytic sites. We will indeed pattern the gold surface with μm resolution, via inject printing or spray coating, and the surface can be functionalized either before or after printing.[3] Importantly, thanks to the nanostructured films, it will be possible to perform *in-operando* monitoring of the reactions with spatial resolution.



a) Catalytic systems with enhanced properties under non-equilibrium conditions will be developed, and **b)** supported on nanostructured microfluidic nanodevices. **c)** This will also allow *on-operando* reaction monitoring.

The obtained knowledge will permit the development of innovative nanodevices and materials.

References

1. Angew Chem. Int. Ed., 2021, 60, 20120-20143
2. ACS Appl. Mater. Interfaces, 2021, 13, 34752-34791
3. Nanoscale Advances, 2023, 5(7), 1970-1977