

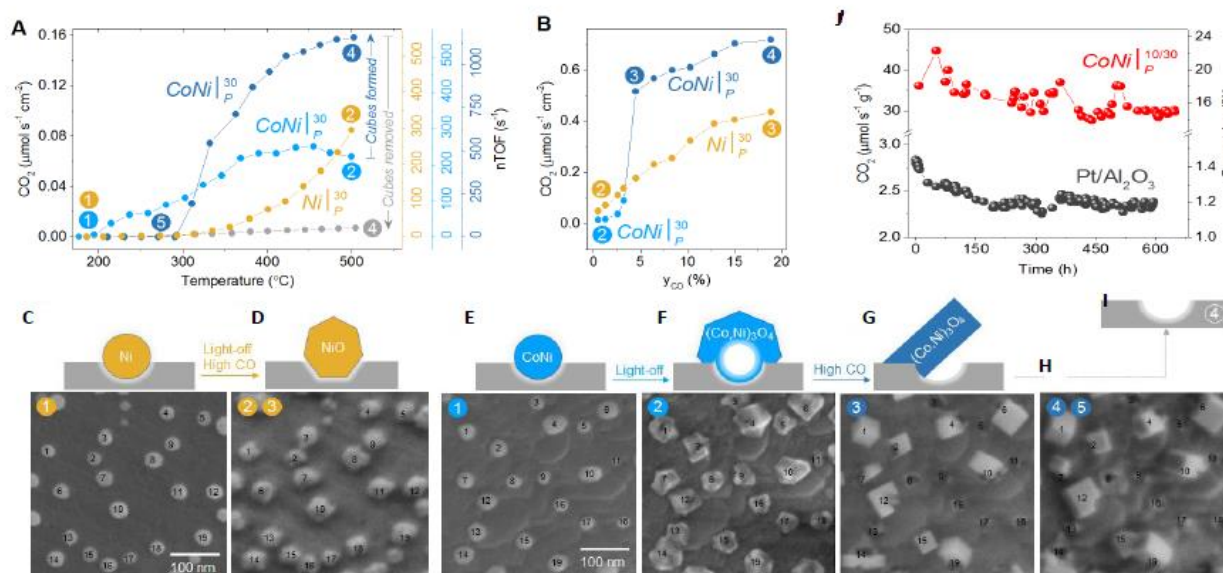
## Demonstrations of chemistry at a point through restructuring and catalytic activation at anchored nanoparticles

Neagu, D.<sup>1</sup>

<sup>1</sup> Newcastle University, United Kingdom

Metal nanoparticles prepared by exsolution at the surface of perovskite oxides have been recently shown to enable new dimensions in catalysis and energy conversion and storage technologies owing to their socketed, well-anchored structure. In this work, we show that contrary to general belief, exsolved particles do not necessarily re-dissolve back into the underlying perovskite upon oxidation. Instead, they may remain pinned to their initial locations, allowing one to subject them to further chemical transformations to alter their composition, structure and functionality dramatically, while preserving their initial spatial arrangement. We prove by tracking individual nanoparticles exsolved from highly A site-deficient perovskites by scanning electron microscopy, X-ray photoelectron spectroscopy and catalytic testing that the exsolved nanoparticles do not re-dissolve upon oxidation but remain fixed in their initial spatial arrangement.

Taking advantage of the proven coking tolerance of exsolved particles, we explore their behaviour under CO-rich regions of the CO oxidation reaction and observe that depending on particle chemistry, intriguing new nanostructures can be formed. These nanostructures rival a state of the art Pt catalyst for the CO and NO oxidation reactions over hundreds of hours of operation, opening exciting possibilities for the design of base metal oxide particles capable of achieving high site activities in tandem with high stability against agglomeration.



**Figure 1.**(A-I)Catalysis, restructuring and activation at confined particles,(J) and long term performance of powder catalysts.

1. Neagu, D.; Papaioannou, E. I.; Ramli, W. K. W.; Miller, D. N.; Murdoch, B. J.; Ménard, H.; Umar, A.; Barlow, A. J.; Cumpson, P. J.; Irvine, J. T. S.; Metcalfe, I. S. Demonstration of chemistry at a point through restructuring and catalytic activation at anchored nanoparticles *Nature communications* **2017**, 8, (1), 1855.