

# Small metal clusters as efficient catalytic species with outstanding stability

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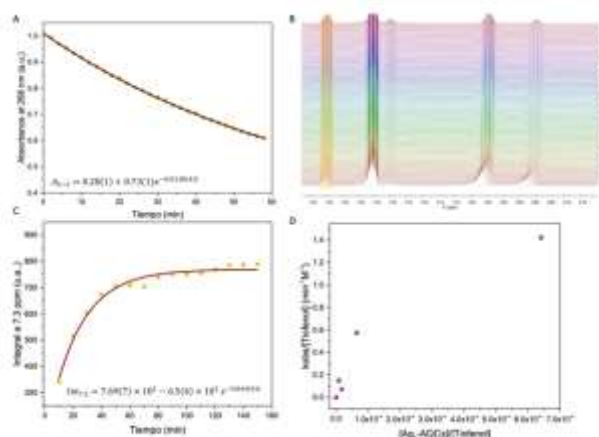
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Transition metal clusters with a small number of atoms ( $\approx 2-10$ ) are considered to be one of the most promising materials in catalysis, because they provide a way to avoid the limitations of both, traditional catalysts (lack of selectivity, cost and availability) and current single-atom catalysis (low degree of versatility to catalyse different kind of reactions) opening new ways to achieve better efficiencies and selectivity at low cost (see e.g. [1-4]).

One of the main concerns in the use of small metal clusters as catalysts is their stability. However, contrary to normal expectations, we have recently observed that small clusters posse outstanding chemical and thermal stabilities even with non-precious metals, such as copper [5]. We will report here details of such outstanding stabilities and some examples of catalytic activities with clusters synthesized by wet chemical procedures supported on oxides [6]. As an example, Figure 1 shows the catalytic aerobic oxidation of thiophenol to sulfone by Ag clusters of 5 atoms at ambient conditions, showing the potential of such clusters for the room temperature aerobic desulfurization of petrol.

## REFERENCES

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**Figure 1:** Time evolution for the aerobic oxidation of thiophenol catalyzed by Ag<sub>5</sub> clusters (Ag<sub>5</sub>-AQCs). A) Absorbance disappeared at 268 nm (diphenyl disulfide) with time for a thiophenol solution of 1 mM with molar ratio  $6.4 \times 10^{-4}$  and the adjustment to an exponential function. B) Proton spectra evolution time for a 15 mM thiophenol solution with a molar ratio with AQCs of  $1 \times 10^{-5}$ . C) Integral at 7.5 ppm versus time for the reaction described in B. D) Observed kinetic constant versus the concentration of Ag<sub>5</sub>-AQCs both divided by the concentration of thiophenol.