Sub-nm metal(0) clusters synthesized with chemical methods: novel and challenging materials of scientific/technological paramount importance

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Metal clusters, Mn, formed by a small number of metal atoms, (n~ < 50-100), protected with different capping agents, are one of the most promising areas of scientific and technological relevance inside the "*nano-arena*" [1]. The reason is that the properties of such small units largely change with only adding or removing one atom to/from the cluster [2]. Metal clusters are characterized by a finite bandgap at the Fermi level or alternatively localized states that lead to a semiconductor-like behavior depending on the size of their bandgap [3]. Although several soft-chemical strategies have been developed in the last years to produce metal clusters, most of them are based on the use of strong ligands (like thiols, phosphines, etc.) as capping and protecting agents [4]. However, the passivation of the cluster surface by these procedures can drastically affect their physicochemical properties, like catalytic, biomedical, etc. We have developed new methods for the synthesis of metal clusters using a kinetic control, which does not require the use of such strong binding ligands [5]. By this procedure we have been able to prepare Au, Ag, Pt, and Cu clusters with different number of atoms (n<≈25) and studied their catalytic, electrocatalytic and photocatalytic properties. In this talk, a summary of these results will be presented with special emphasis of their "*impressive*" photocatalytic activities, showing that clusters can be used as very stable, efficient and reusable catalysts for water splitting, degradation of organics, etc.

References

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