Highly Photoluminescent $PdAu_{12}$ and $PtAu_{12}$ Clusters Protected by Bidentate N-Heterocyclic Carbenes

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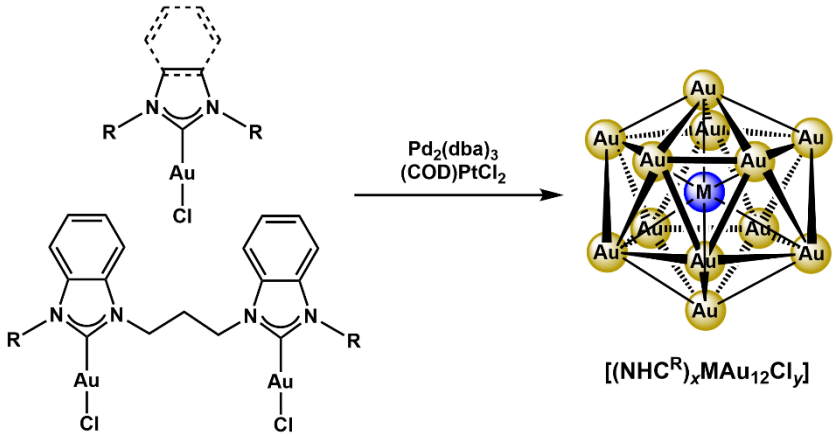
The development of novel cancer therapeutics continuously drives research on nanotechnology-based immunotherapy.[1] Due to their high chemical and biostability, in combination with facile tuneable photoluminescence (PL) properties, gold nanoclusters (AuNCs) represent an ideal platform for application as bioimaging and therapy agents.[2] In recent years, N-heterocyclic carbenes (NHCs) have emerged in AuNCs as protective ligands due to their highly stabilizing properties.[3] In combination with heteroelement doping, an optimization of the PL properties is feasible,[4] which is desired in order to enhance their performance as bioimaging and therapy agents.

Here, we wish to report on the extension of the previously established synthesis of NHC-protected Au clusters toward transition-metal (M) doped NHC-AuNCs. Three different factors of PL enhancement were investigated: (1) The effect of mono- or bidentate NHCs, (2) the effects of NHC wingtip modification, and (3) the effect of heteroelement doping. The respective NHC-Au precursor complexes were co-reduced with transition metal complexes to afford cluster of the general composition $(NHC)_9MAu_{12}Cl_3$ (monodentate NHC) and $(NHC)_5MAu_{12}Cl_2$ (bidentate NHC). Depending on the type of ligand and dopant, quantum yields of >50% can be realized, which are among the highest reported for NHC-Au clusters so far.



Scheme 1. Synthesis of transition-metal doped $(NHC)MAu_{12}$ clusters via co-reduction method.

References

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