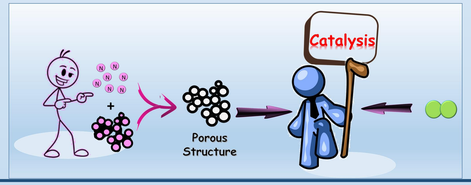
Heterogenization of NiAu Nanoparticles into Nanoporous Carbon Derived from Covalent Triazine Frameworks: An Efficient Catalyst for Hydrogenation Reactions

Kesavan Nithya, Vairathevar Sivasamy Vasantha and Arlin Jose Amali*

Department of Natural Product Chemistry, School of Chemistry, Madurai Kamaraj University, Madurai – 625 021, India.

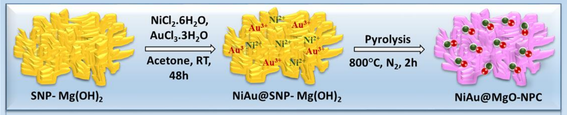
Introduction

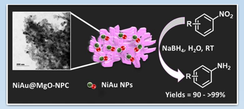
- Covalent frameworks are promising candidates as precursors to produce nitrogen (N) -doped nanoporous carbon (NPC) materials due to their combination of tunable functionality of pore structure and tailored N- sites to imbed active sites.
- The support effect of MgO induces electron transfer between the metal and the support, altering the catalytic properties of the metal.
- The synergistic effect of bimetal catalysts in nanocatalysis increases the catalytic activity of its monometallic counterparts while also increasing selectivity in several organic transformations.



Methodology

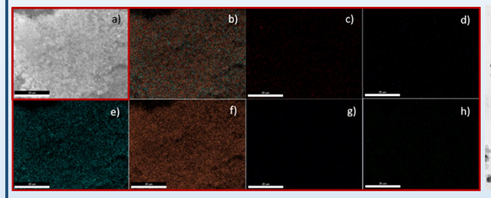
- Schiff-base Network Polymer (SNP) was synthesized using 1,3,5-Triazine-2,4,6-triamine and 1,4-benzenedicarboxaldehyde .
- Ni and Au ions were incorporated into SNP along with $Mg(OH)_2$ by impregnation method which on pyrolysis yields NiAu@Mgo-NPC.
- The catalytic activity of NiAu@Mgo-NPC was examined for hydrogenation reactions.



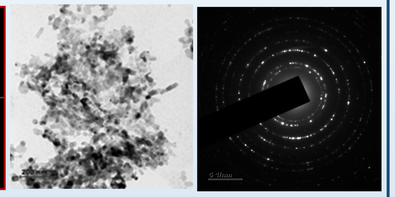


Results

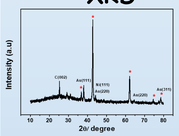
EDS Mapping



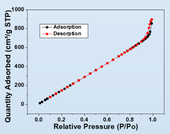
TEM and SAED

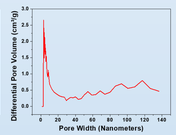


XRD

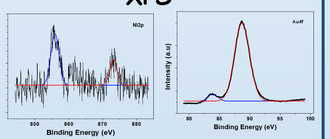


BET

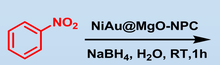


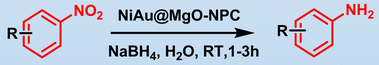


XPS

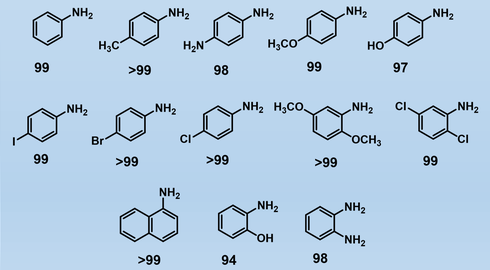


Hydrogenation of aromatic nitro compounds catalysed by NiAu@MgO-NPC[a]



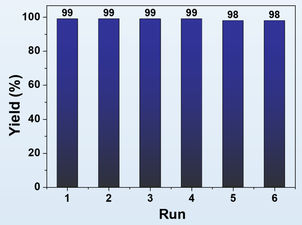


Ni_xAu_y@MgO-NPC	Yield (%)[b]
$Ni_{50}Au_{50}$	99
$Ni_{100}Au_0$	68
Ni_0Au_{100}	84



[a]Reaction condition: Nitrobenzene (0.5 mmol), $NaBH_4$(12.5 mmol) catalyst (10 mg of 1 wt%), solvent(5 mL), RT, [b]GC yield.

Reusability*



*Under Optimized condition

Hot filtration Test[a]

Catalyst	Yield (%)[b]		
NiAu@MgO-NPC	0.5h	0.5h	Reusability
	67	67	99

[a]Reaction Conditions: Nitrobenzene (0.5 mmol), $NaBH_4$(12.5 mmol) catalyst (10 mg of 1 wt%), solvent(5 mL), RT, [b]GC yield.

Novelty

NiAu@MgO-NPC

- Recyclable
- Heterogeneous in nature
- Higher catalytic efficiency

Conclusion

- N-rich carbon matrix derived from Schiff-base Network Polymer promotes the dispersion of NiAu NPs.
- The catalytic performance of NiAu@MgO-NPC was tested for hydrogenation reactions and NiAu NPs result in structurally stable catalytic sites, which makes them recyclable without any loss in their activity.

References

- X. Xu, Y. Li, Y. Gong, P. Zhang, H. Li, Y. Wang, *J. Am. Chem. Soc.*, 2012, **134,** 16987.
- Z. Li, J. Liu, C. Xia, F. Li, *ACS Catal.*, 2013, **3**, 2440.
- Sankar, M.; Dimitratos, N.; Miedziak, P. J.; Wells, P. P.; Kielye, C. J. Hutchings, G. J. *Chem. Soc. Rev.* 2012, **41**, 8099.
- Z. Yang, S. Liang, L. Sun, X. Hu, W. Fang, W. Lai, X. Yi, *Fuel*, 2021, **289,** 119920.

