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Green epoxidation of cyclooctene with molecular oxygen over an ecofriendly heterogeneous polyoxometalate-gold catalyst $Au/BW_{11}/Al_2O_3$

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Key-words: Nano gold; polyoxometalate; cyclooctene; epoxidation; molecular oxygen.

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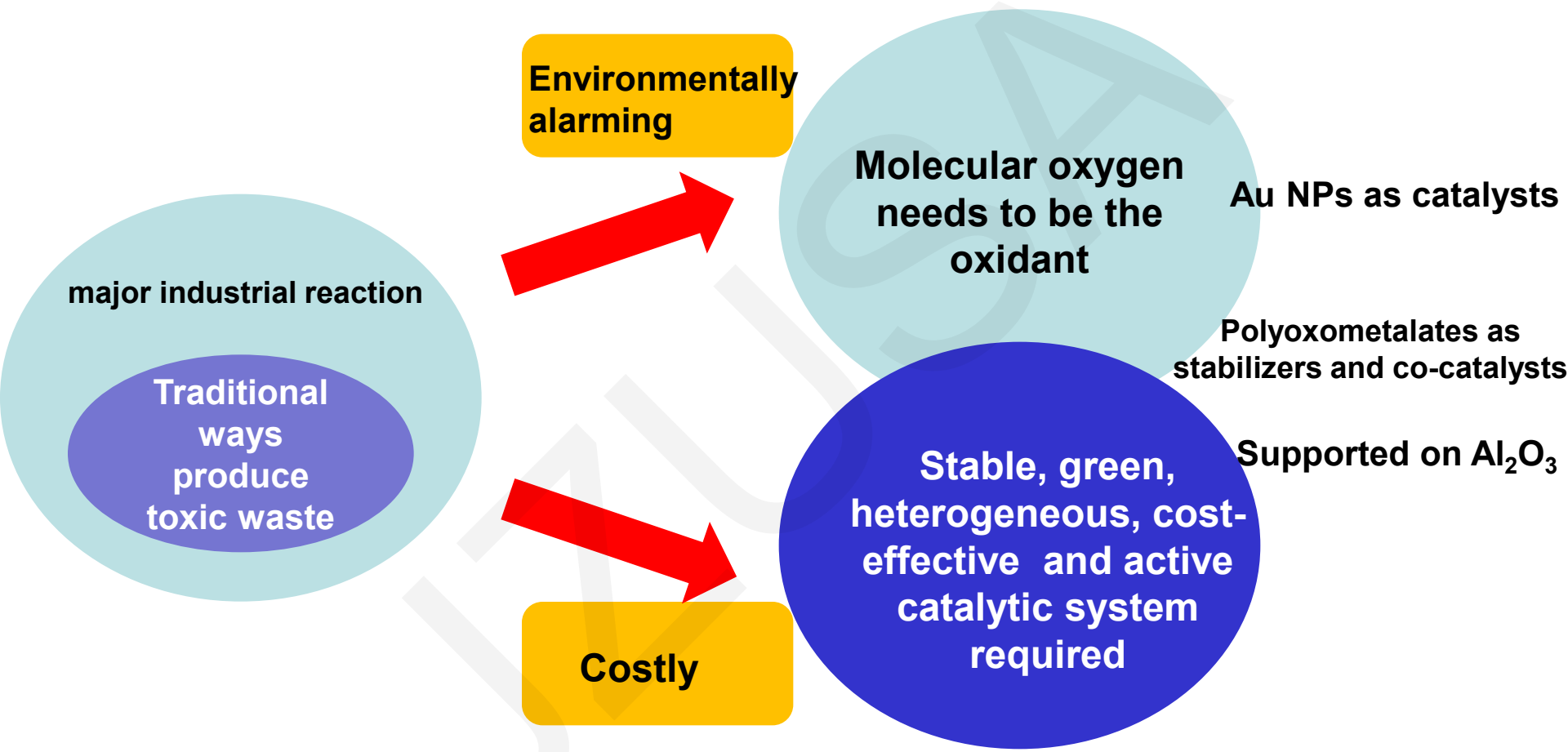
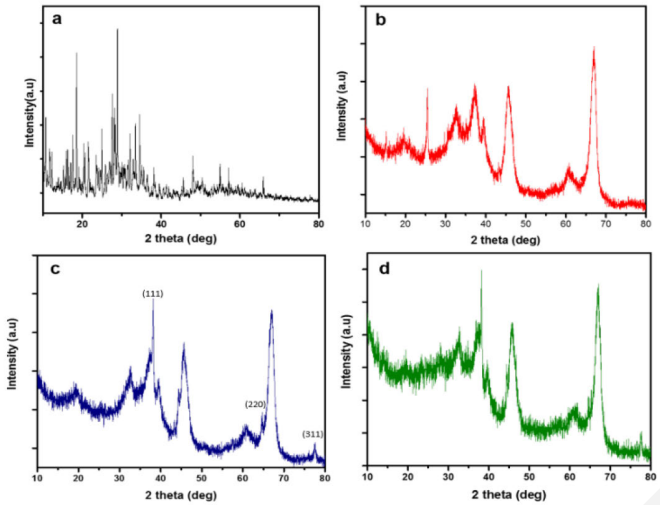
Olefin Epoxidation



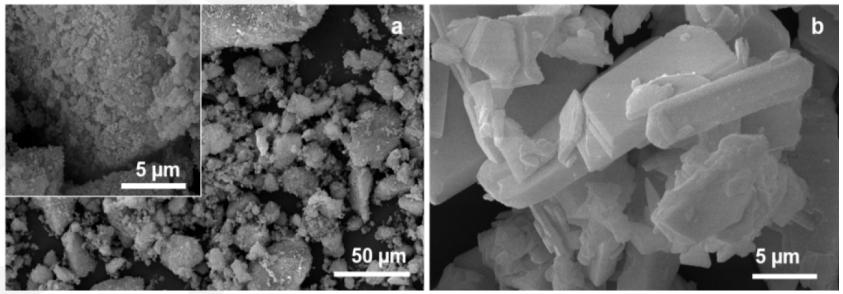
Experimental Method

- Synthesis of Polyoxometalate BW_{11}
- Synthesis of Au/Al_2O_3
- Synthesis of hybrid catalyst $Au/BW_{11}/Al_2O_3$
- Characterization of the hybrid catalytic materials
- Application for epoxidation of cyclooctene with O_2 as oxidant under mild conditions

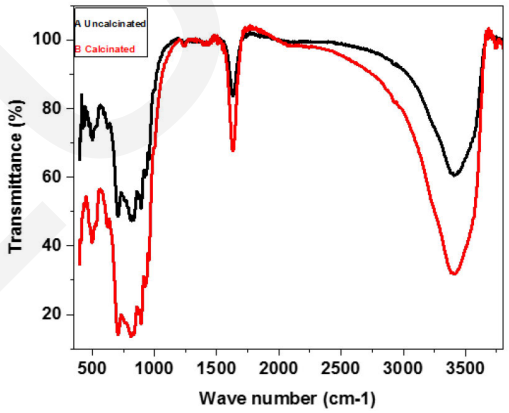
Successful Synthesis



XRD patterns of Keggin type a) BW_{11}, b) bare Al_2O_3, c) Au/Al_2O_3, d) $Au/BW_{11}/Al_2O_3$



SEM Images of (a) $Au/BW_{11}/Al_2O_3$, (b) BW_{11}



FT-IR spectra of BW_{11} A) uncalcinated, B) calcinated at 500° C for 3 hours

Results and Conclusions

- The reaction was optimized using different parameters such as the calcination temperature of the catalyst, the catalyst dosage, reaction temperatures and time, different oxidants along with a variety of solvents.
- The catalyst $Au/BW_{11}/Al_2O_3$ performed very well for cyclooctene epoxidation giving a good conversion as high as 46% and excellent selectivity for epoxide as high as 92% under specific reaction conditions.
- The catalyst utilized molecular O_2 efficiently as the oxidant and achieved good results without the use of high temperature and organic solvents.
- The catalyst was stable to heat and recyclable after successive catalytic cycles during the analysis.

Results and Conclusions

- In conclusion, the solid catalytic system $Au/BW_{11}/Al_2O_3$ combining gold nanoparticles and the Keggin type POM over γ-Al_2O_3 support for aerobic epoxidation of olefins is highly active under mild conditions without using any organic solvent.
- The superiority of the catalyst lies in an efficient activation of molecular oxygen and cyclooctene.