# Undoped and Al-doped ZnO nanoparticles for photocatalytic application

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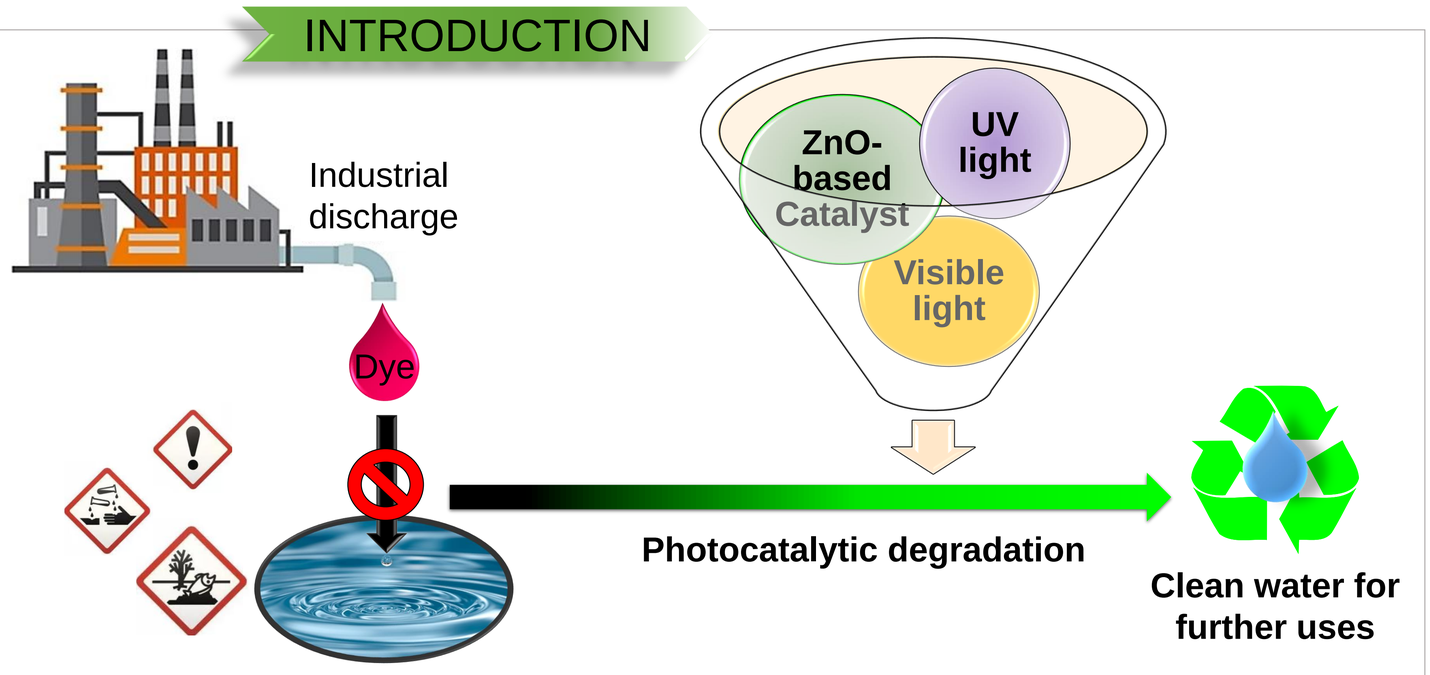
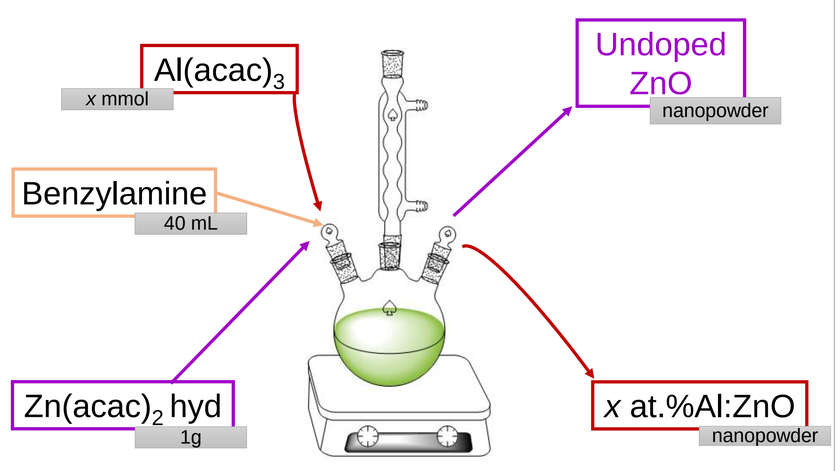
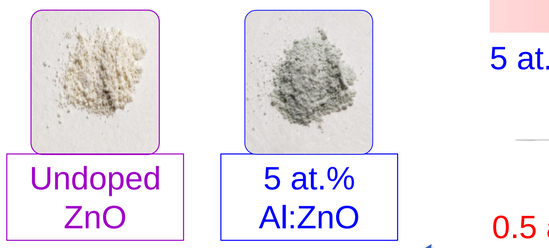
## INTRODUCTION

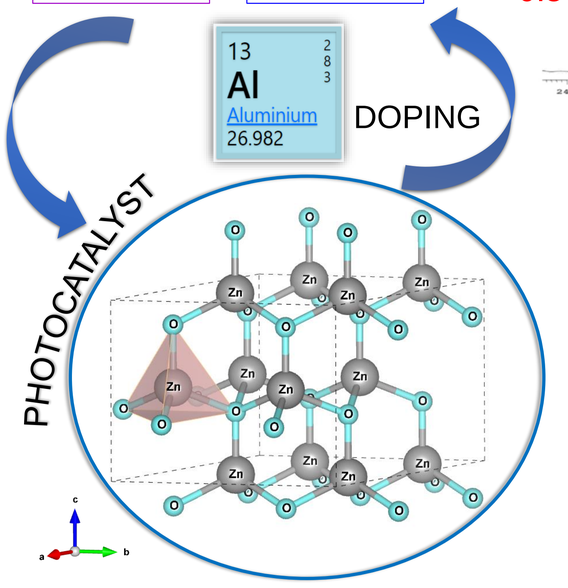



## SYNTHESIS

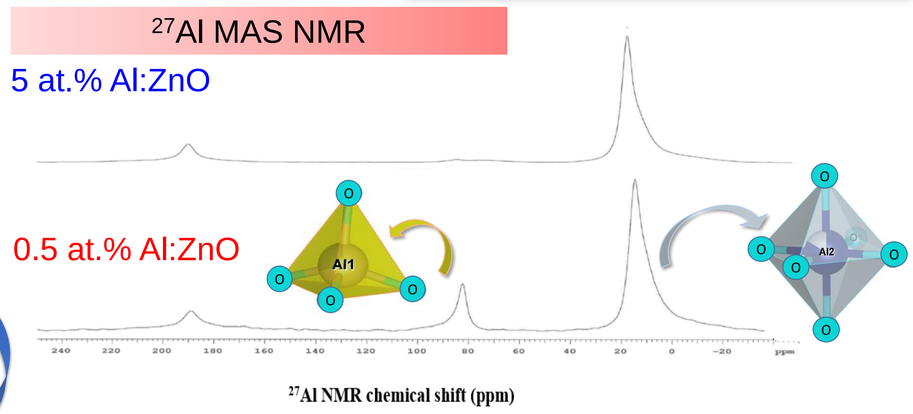



## CHARACTERIZATION



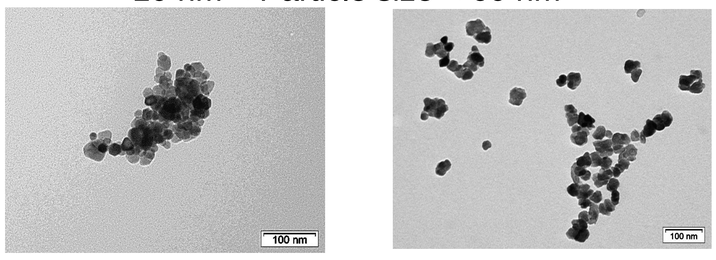




### $^{27}$Al MAS NMR



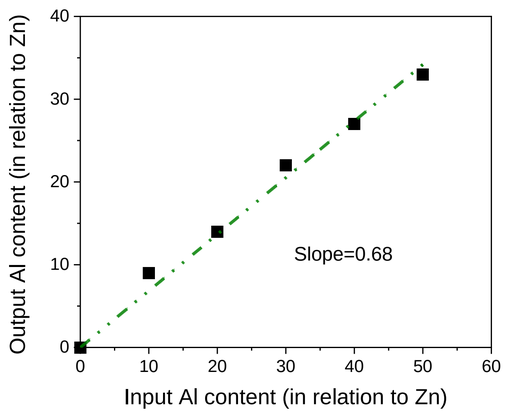

### TEM Images

10 nm < Particle size < 60 nm

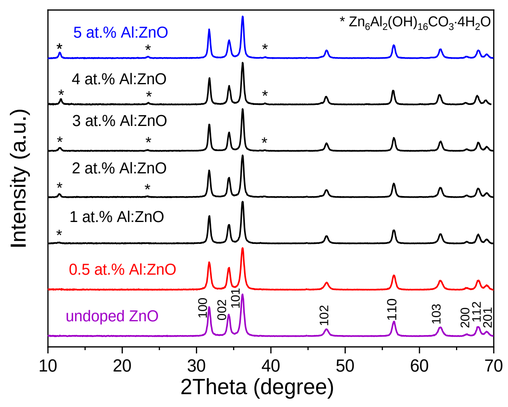



Undoped ZnO — 5 at.% Al:ZnO

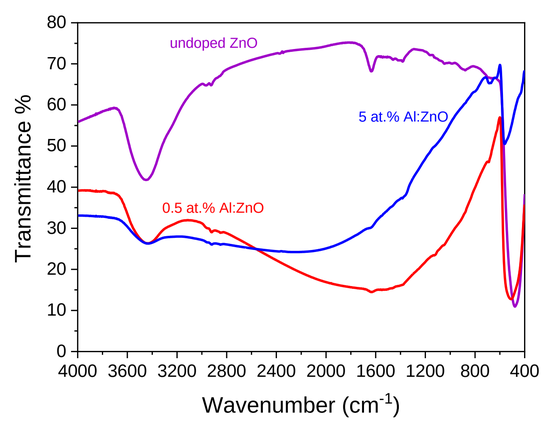
### ICP-OES




### PXRD match: wurtzite phase




### FTIR spectra: SPR band




## CATALYTIC RESULTS

### Photocatalytic degradation




**Rhodamine B dye (RhB)**

| Material type | RhB Dye Degradation [%]** UV-C 254 nm* | RhB Dye Degradation [%] UV-A 368 nm* | RhB Dye Degradation [%] Visible 450 nm* |
|---|---|---|---|
| Commercial ZnO | 94 | 96 | 8 |
| Undoped ZnO | 45 | 70 | 20 |
| 0.5 at.% Al:ZnO | 41 | 53 | 22 |
| 5 at.% Al:ZnO | 21 | 19 | 12 |

* Reactions performed at RT, 5 mg of catalyst, 20 mL of dye (RhB, 4 mg/L) for 20 min using 11W OSRAM UV-C, 11W OSRAM UV-A and 30W Strip LED lamps.

** $\textbf{Degradation}\ \% = \frac{(A_0 - A)}{A_0} * \mathbf{100}$, $A_0$ is the Absorbance of the starting solution before reaction and $A$ is the final absorbance measured after reaction.

### Energy band gap




## CONCLUSIONS

- Synthesis of undoped ZnO and Al:ZnO materials (0-5 at.%) ✓
- Physical - chemical characterization ✓
- Photodegradation: undoped ZnO and 0.5 at.% Al:ZnO showed the best performance under visible light ✓
- Correlation between Al positions and photocatalytic activity — **Near future plan**
- **Future plan**: Solar light simulator for photocatalytic dye degradation

References

1. I. John Peter, E. Praveen, G. Vignesh and P. Nithiananthi, *Mater. Res. Express*, 2017, **4**, 124003.
2. A. Momot, M. N. Amini, G. Reekmans, D. Lamoen, B. Partoens, D. R. Slocombe, K. Elen, P. Adriaensens, A. Hardy and M. K. Van Bael, *Phys. Chem. Chem. Phys.*, 2017, **19**, 27866–27877.

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