# Palladium nanoparticle catalysts in ionic liquids: synthesis, characterisation and hydrogenation of alkenes with an ionically-tagged ligand

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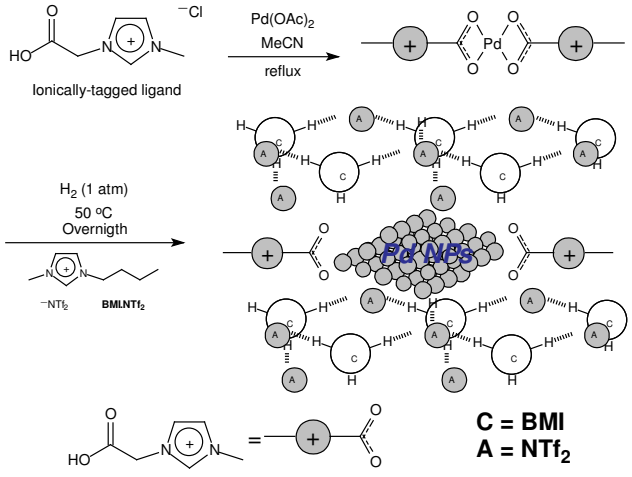
## INTRODUCTION

Metal nanoparticles (NPs) are used widespread in catalysis to promote a plethora of reactions. In order to prevent the metal bulk formation, NPs must be stabilized. In this sense, it is possible to use different stabilizing agents such as ionic liquids (ILs), which can provide both steric and electronic protection against the NPs spontaneous aggregation.[1]

In the present work, we describe the use of a novel ionically-tagged palladium complex used as the precursor to NPs formation in ILs.

## RESULTS AND DISCUSSION

Palladium NPs containing the ionically-tagged ligand were prepared *in situ*, as shown in Scheme 1.




**Scheme 1.** Syntheses of the ligand and the Palladium complex.

The freshly prepared Pd NPs were characterized by transmission electron microscopy (TEM, Figure 1) and their catalytic activity directly tested in the hydrogenation reaction of cyclohexene at 50 ºC and 1 atm of $H_2$ (Figure 2) for 24 h. The tested conditions displayed a good performance and the desired product was obtained in 50 % yield. It is worth noting that this reaction is usually carried out at higher temperatures and pressures. It is important to notice that no significant difference was observed in the NPs size distribution after catalysis (before catalysis, (4,08 ± 2,56) nm, and after catalysis (3,67 ± 2,04) nm, shown in Figure 2), which we attribute to the stabilizing effect of the ionically-tagged ligand.

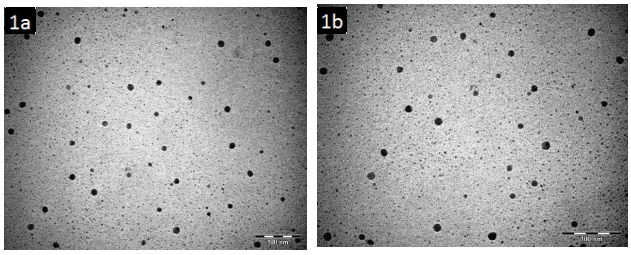



**Figure 1.** TEM of NPs supported in IL (a) before the reaction and (b) after the reaction.

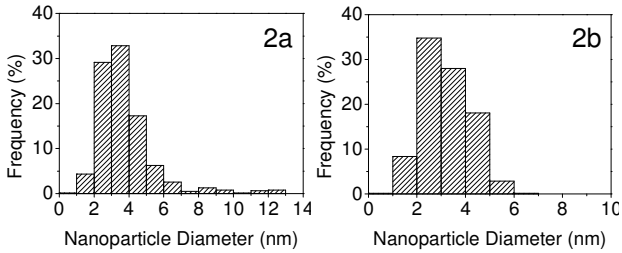



**Figure 2.** Size distribution of Pd NPs (a) before catalysis and (b) after catalysis.

The size distribution indicates only small aggregation after the catalysis, rendering the catalytic system a promising strategy to avoid nanoparticle agglomeration.

## CONCLUSION

An ionically-tagged ligand was efficiently tested as an additional stabilizing agent for Pd NPs systems with promising catalytic activity in hydrogenation reactions.

## ACKNOWLEDGEMENTS

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## REFERENCES

[1] Dupont, J.; Scholten, J., Chem. Soc. Rev. **2010**, 39,1780.