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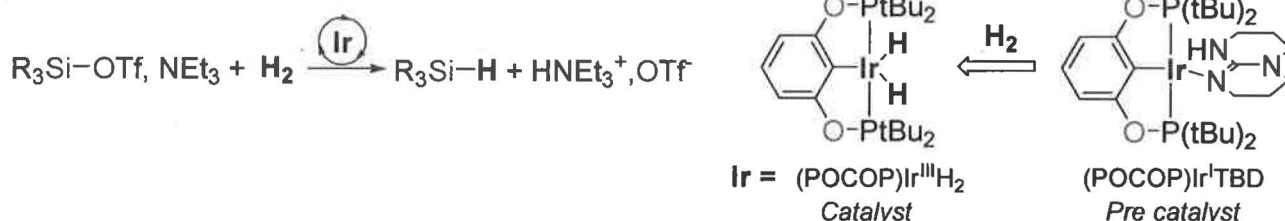
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Catalytic hydrogenolysis of silyl triflates to hydrosilanes using iridium pincer complexes

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Hydrosilanes are convenient reductants for a large variety of organic oxygenated substrates and they have been successfully applied in the conversion of bio-based materials¹ and CO₂.² At present, hydrosilanes are produced *via* energy intensive processes³ and they generate, after use, silicon oxides wastes such as siloxanes, which are difficult to recycle. These limitations call for the development of catalytic processes able to transform Si-O bonds in siloxanes and derivatives (silyl halides and triflates) into Si-H hydrides.

Very recently, the groups of Shimada⁴ and Schneider⁵ reported for the first time the hydrogenolysis of some silyl halides and triflates with iridium(III) catalysts and ruthenium(II). Following these preliminary reports, we studied the catalytic hydrogenolysis of R₃SiOTf (R = Me, Et, Ph) species in the presence of a base, by the dihydride complex (POCOP)IrH₂ (See figure above). Syntheses and crystal structures of some isolated Ir(I) and Ir(III) complexes will be presented as well as their role in the R₃SiOTf to R₃SiH transformation.

The new (POCOP)Ir^I(TBD) complex, which splits H₂ to (POCOP)Ir^{III}H₂ at a low pressure, is a pre-catalyst in the hydrogenolysis of Si-OTf linkages. It can be easily obtained from (POCOP)IrHCl, using the TBD guanidine. To the best of our knowledge, such spontaneous reductive elimination by a weak base of an iridium(III) hydro-chloride species is novel.

The kinetic and thermodynamic profiles of the reaction were examined by means of spectroscopic and DFT studies. The mechanism reveals that rate determining step is the hydride transfer from (POCOP)IrH₂ to the silyl triflate. The base (e.g. NEt₃) is required to drive the thermodynamics of the reaction, by promoting the regeneration of iridium hydrides intermediates, in the presence of H₂.

References

1. Monsigny L. *et al. Green Chem.* **2018**, *20*, 1981
2. Riduan, S.N., Zhang, Y. & Ying, J.Y. *Angew. Chem. Int. Ed.* **2009**, *48*, 3322
3. Kalchauer, W.; Pachaly, B. *In Handbook of Heterogeneous Catalysis*
4. (a) Tsushima *et al. Chem. Lett.* **2017**, *46*, 1532–1534. (b) Beppu T. *et al. J. Org. Chem.* **2018**, *869*, 75–80
5. Glüer A. *et al. Inorg. Chem.* **2018** *57* (21), 13822–13828