Palladium Nanoparticles Immobilized on Exfoliated Black Phosphorus.

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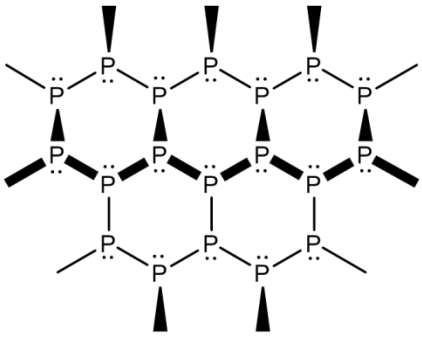
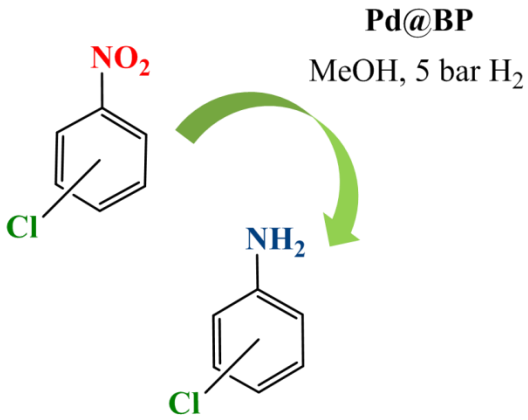
The first reported mechanical exfoliation of black phosphorus in 2014 aroused great enthusiasm in the scientific community opening up new horizons in material science.(1) The novel bidimensional material, 2D BP, exhibits promising semiconductor properties with a broad prospect in the construction of electronic devices. In this respect a prominent feature of 2D BP is the thickness-dependent band gap, ranging from 0.3 eV (bulk material) to 1.8 eV (monolayer). In our laboratory black phosphorus crystals were grown(2) and sonochemically exfoliated to obtain 2D BP. Given the sp^3 hybridization and the formal presence of a lone pair on each P-atom, we argued that 2D BP would be an excellent support to immobilize metal nanoparticles and turned our attention on palladium. The growth of palladium nanoparticles was performed in situ by reduction of a Pd(II) salt in presence of exfoliated black phosphorus. Thus, the new material Pd@BP was characterized by TEM, XRD and Raman spectroscopy and afterwards was tested as catalyst in the hydrogenation of halonitroarenes to haloanilines. Despite different reports showing lack of selectivity of Pd-based catalysts, Pd@BP turned out to reduce chloronitroarenes with excellent selectivity even at high conversions, pointing out the relevant role of 2D BP as a support.





References

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2. Lange, S. ; Schmidt, P.; Nilges, T. *Inorg. Chem*., **2007**, *46*, 4028.