2D black phosphorus decorated with palladium nanoparticles.
Synthesis, characterization and catalytic applications

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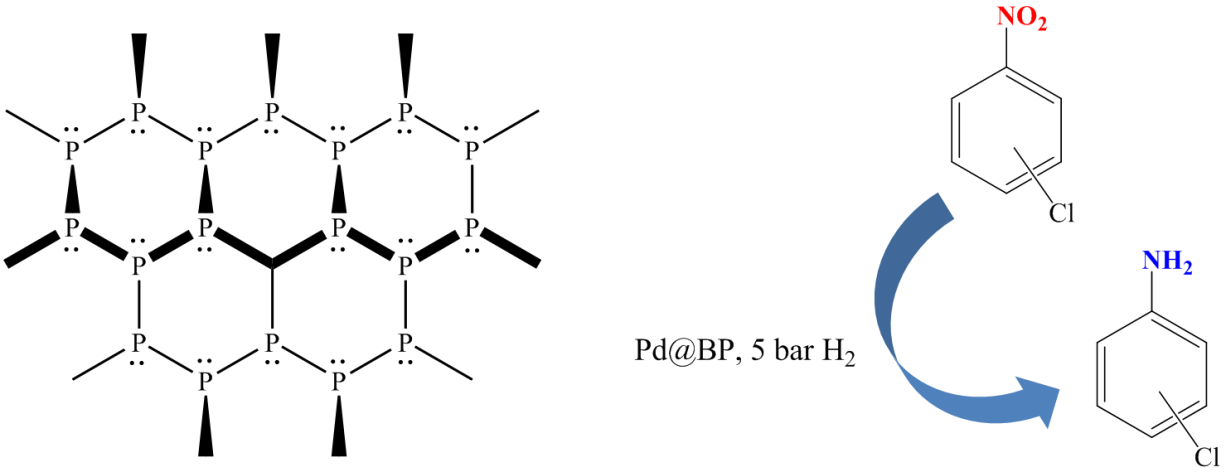
Black phosphorus, firstly prepared by physicist Percy Bridgman in 1914, was recently rediscovered after the report of its mechanical exfoliation.(1) The resulting bidimensional material (2D BP), a phosphorus-based counterpart of graphene, aroused tremendous interest given its semiconductor properties with a layer dependent band gap, ranging from 0.3 eV (bulk material) to 2.0 eV (monolayer). However, a major drawback limiting the applications of 2D BP is its instability toward the mutual effect of oxygen, water and light. In our labs, 2D BP was prepared by sonochemically assisted solvent exfoliation of bulk black phosphorus under inert atmosphere.(2) We speculated that given the formal presence of a lone pair on each P-atom, 2D BP would be an excellent material to anchor metal nanoparticles(3) and turned our attention to palladium. The growth of palladium nanoparticles was performed in situ by reduction of a Pd(II) salt previously impregnated on the surface of 2D BP. TEM observation of the resulting material (Pd@BP) showed a good covering of 2D BP flakes by Pd nanoparticles. Pd@BP was then tested as catalyst in the hydrogenation of halonitroarenes to haloanilines, a reaction often affected by dehalogenation byproducts. Higher selectivity compared to known heterogeneous catalysts based on supported Pd nanoparticles was observed, pointing out the relevant role of 2D BP as support.



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References

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