Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

Palladium(0) nanoparticles supported on polydopamine coated Fe_3O_4 as magnetically isolable, highly active and reusable catalyst for hydrolytic dehydrogenation of ammonia borane

Joydev Manna, Serdar Akbayrak, Saim Özkar†

Department of Chemistry, Middle East Technical University, 06800, Ankara, Turkey.

† Corresponding Author: sozkar@metu.edu.tr

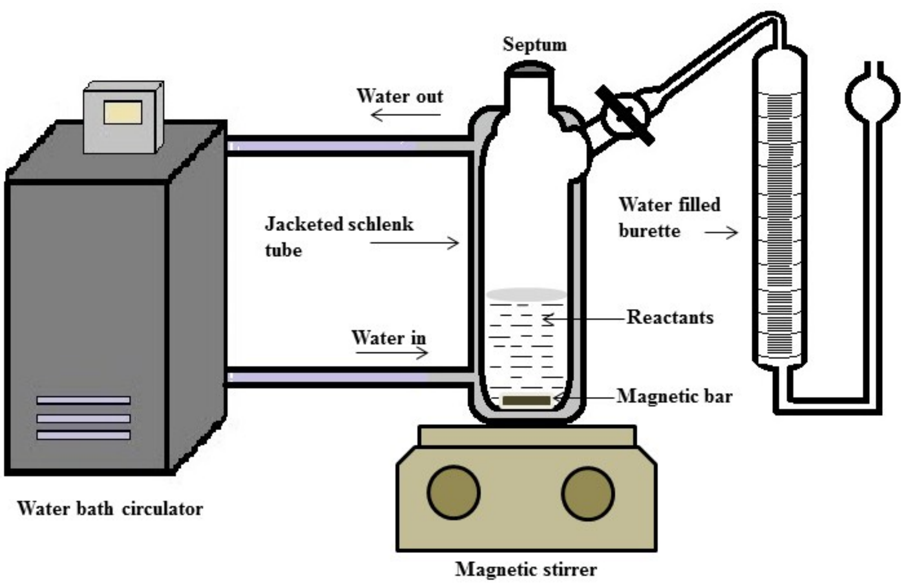

Figure S1: Schematic diagram of the reaction setup used for AB hydrolysis

Optimization of dopamine chloride salt concentration:

Before starting our study with the catalysts, we have optimized the initial polydopamine salt concentration to prepare the PDA coated Fe_3O_4 nanoparticles. In that process, we have changed the polydopamine salt concentration from 0.5 to 8 mg/mL and observed the amount of polymer coated on the sample by measuring mass of the samples. Details of the synthesis condition is given in Table S1. As it can be seen from the Fig. S2, amount of polymer coating increases with increasing the dopamine chloride concentration and at higher concentration the mass change becomes negligible. Since the mass increase in Fe_3O_4 powder shows no large variation at higher salt concentration, it can be concluded that the thickness of dopamine layer is also not varied significantly at dopamine concentrations higher than 4 mg/mL largely for these sample.

Table S1: Synthesis condition of polydopamine coated Fe_3O_4 (* denotes the ratio of mass of dopamine salt/volume of buffer solution).

Volume of buffer solution (mL)	Conc. of dopamine chloride (mg/mL)*	mass of Fe_3O_4 (mg)	Mass increase in Fe_3O_4 powder (mg)	Thickness measured by TEM (nm)
50	0.5	280	8.3	-
50	1	280	30.8	-
50	2	280	34.6	-
50	4	280	40.1	3.0
50	8	280	41.4	-

After PDA coating on Fe_3O_4 nanoparticles, palladium nanoparticles (2.0% wt) were supported on the surface of PDA-Fe_3O_4 (prepared by using 2, 4 and 8 mg/mL dopamine chloride) and the catalytic activity of the catalysts was tested in hydrogen generation from the hydrolysis of ammonia borane. As shown in Fig S3, the Pd/PDA- Fe_3O_4 catalyst prepared by 4 mg/mL of dopamine hydrochloride salt shows higher catalytic activity than the other two samples. Therefore, 4 mg/mL of dopamine hydrochloride salt, which provides an average thickness of 3.0 ± 0.5 nm dopamine layer, was used for the coating of Fe_3O_4 nanoparticles.

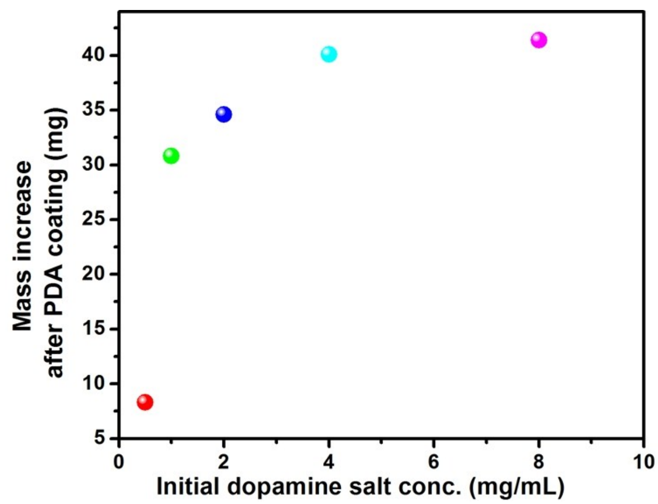

Fig S2. Mass increase after polymer coating on the surface of Fe_3O_4 nanoparticles at various initial dopamine salt concentration used for PDA coating

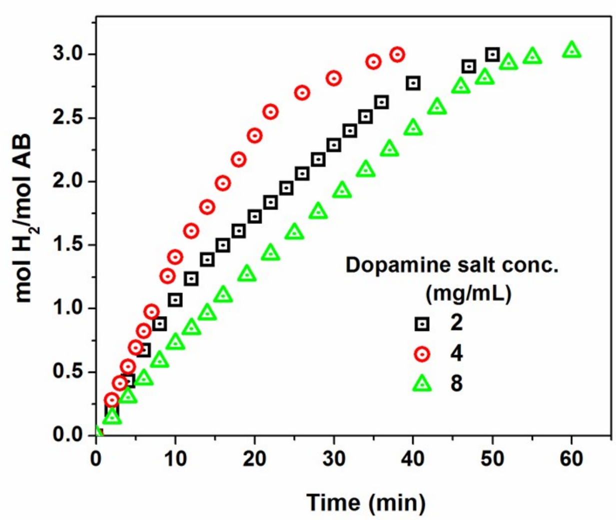

Fig S3: Plots of equivalent H_2 per mole of AB versus time during the catalytic hydrolysis of AB using the Pd^0/PDA-Fe_3O_4 catalyst (2.0% wt. Pd) for hydrogen generation from the hydrolysis of ammonia borane at 25.0 ± 0.1 °C (PDA-Fe_3O_4 was prepared by changing the initial dopamine salt concentration for each run).

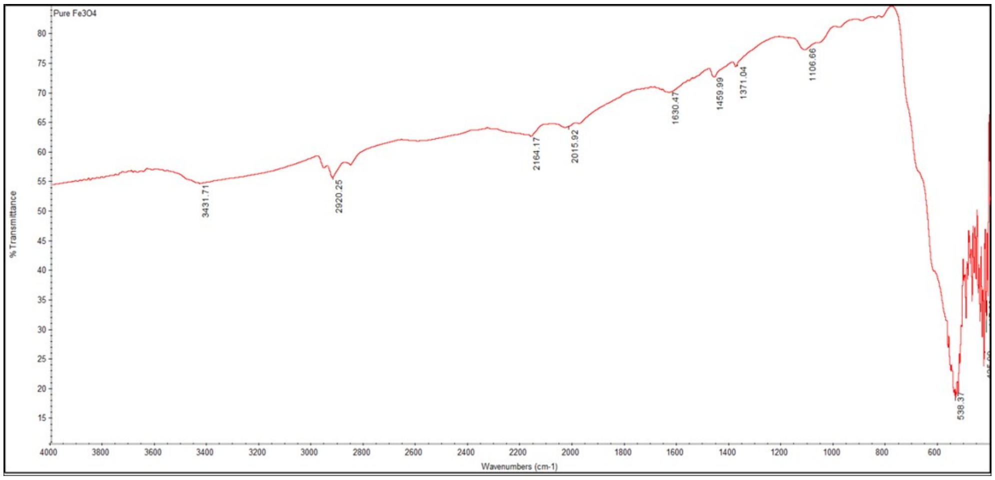

Fig S4: FTIR spectra of Fe_3O_4

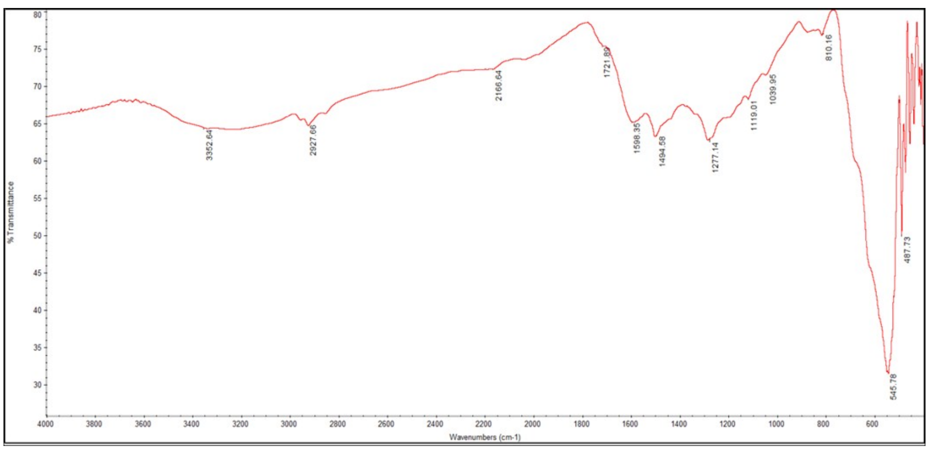

Fig S5: FTIR spectra of PDA-Fe_3O_4

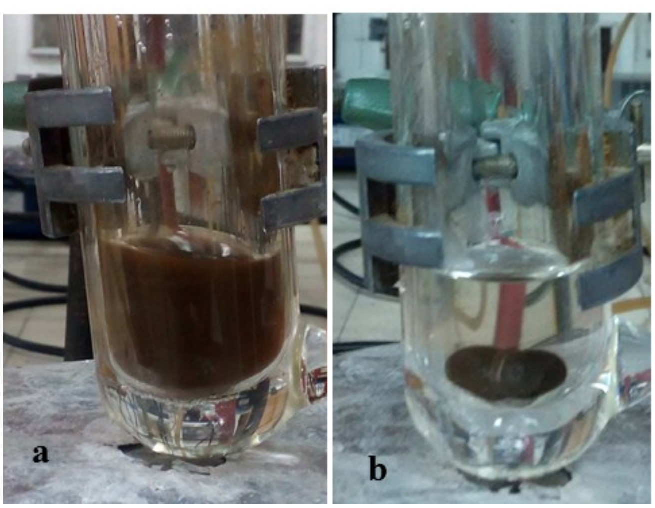

Fig S6: Photograph of the Pd^0/PDA-Fe_3O_4 catalyst inside the reactor (a) during stirring (b) without stirring