Supporting Information

Synergistic Effect of Interfacial Phenomenon on Enhancing Catalytic Performance of Pd Loaded MnO_x-CeO_2-C Hetero-nanostructure for Hydrogenation and Electrochemical Reactions

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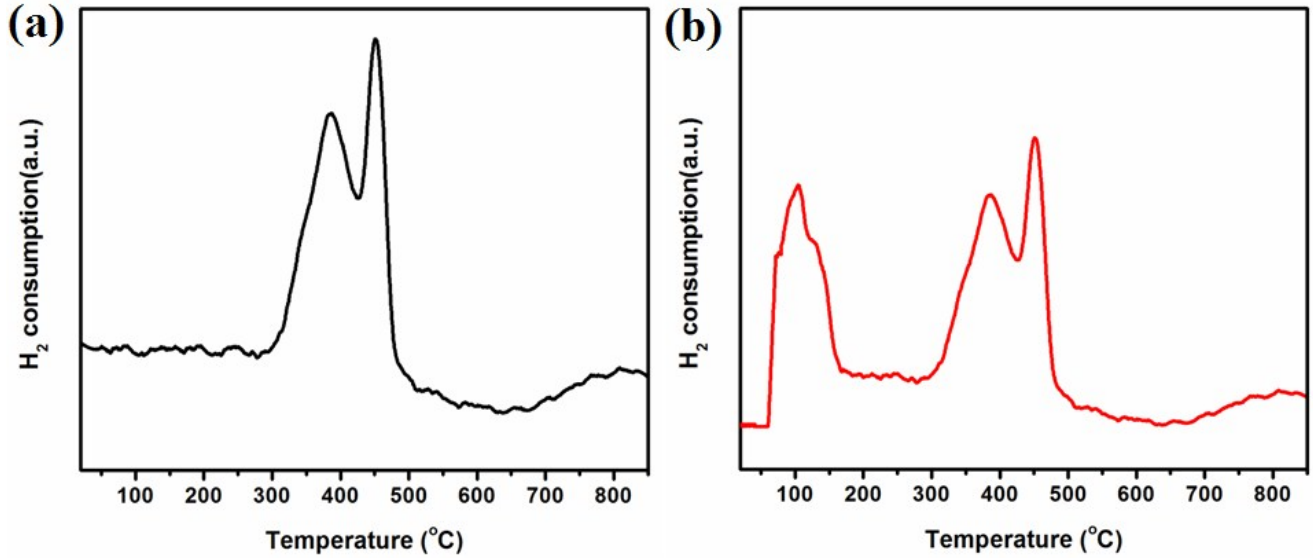

Fig. S1. Temperature-programmed reduction (TPR) spectra of **(a)** MnO_x-CeO_2-C and **(b)** Pd/MnO_x-CeO_2-C catalysts.

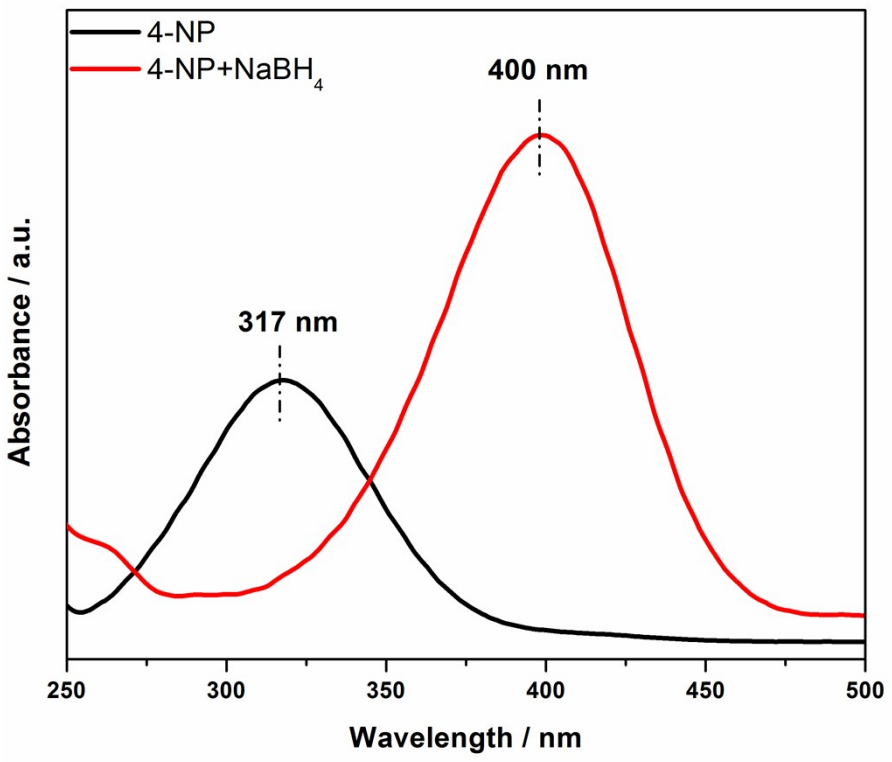

Fig. S2 4-NP absorption peak before and after addition of $NaBH_4$

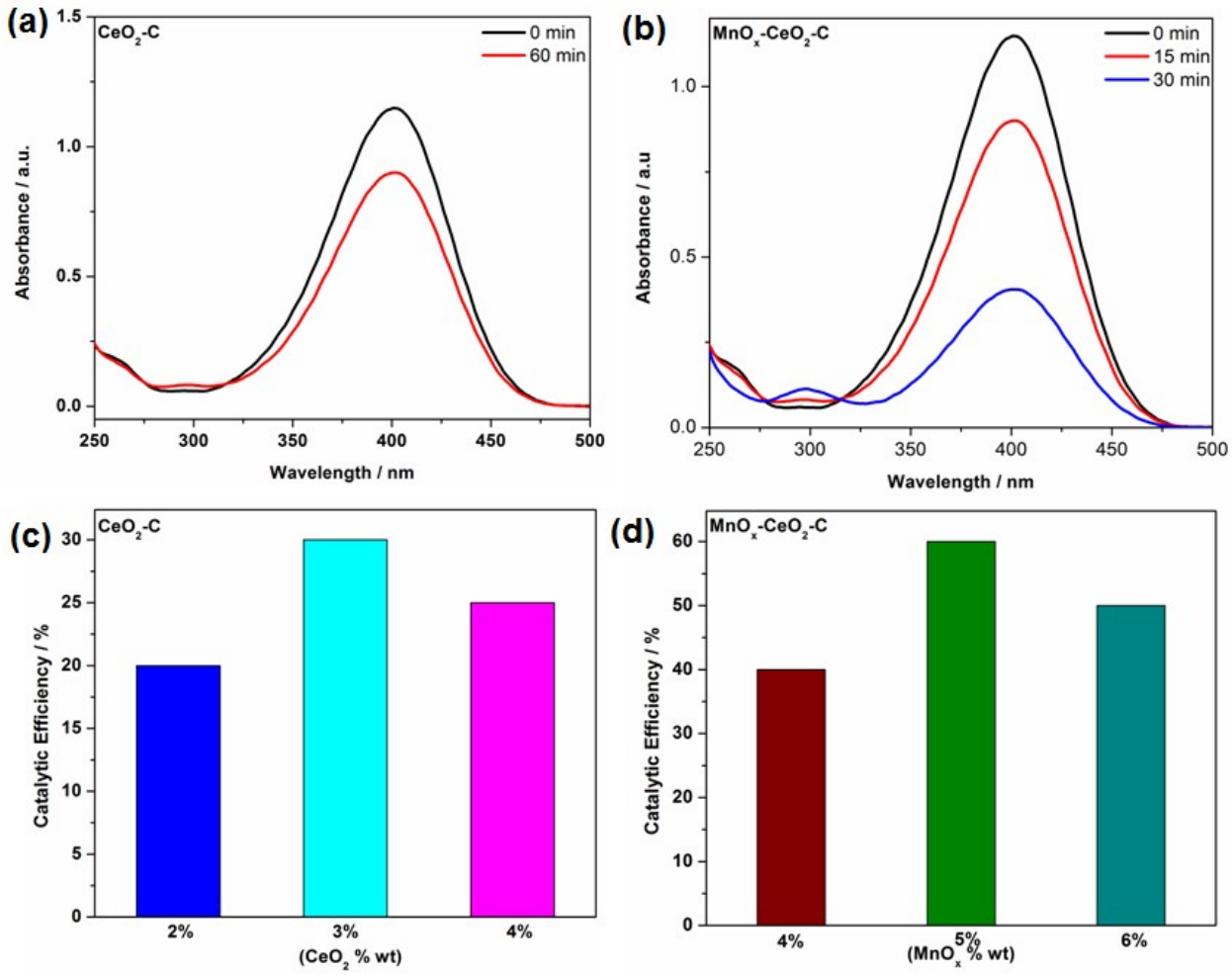

Fig. S3 (a) UV-absorption spectra for the reduction of 4-nitrophenole into 4-aminophenol by using catalyst CeO_2/C and **(b)** 4-NP reduction efficiencies by using different %age of CeO_2., **(c)** UV-absorption spectra for the reduction of 4-nitrophenole into 4-aminophenol by using catalyst MnO_x/CeO_2/C and **(d)** 4-NP reduction efficiencies by using different %age of MnO_x.

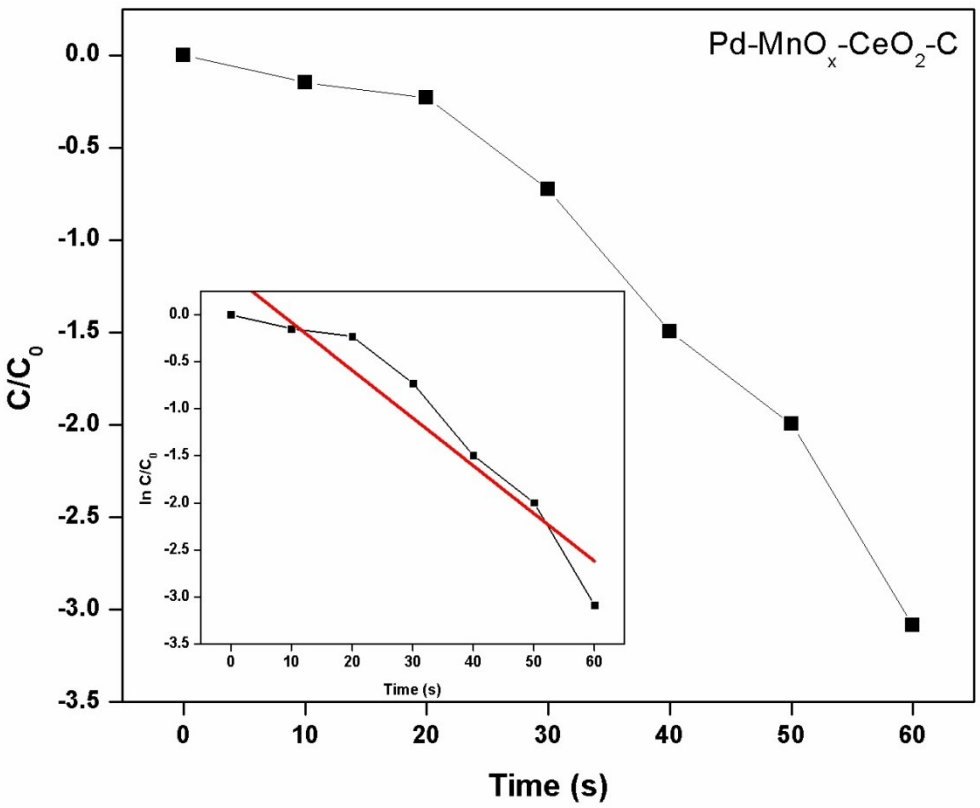

Fig. S4 C/C_0 vs Time plot and inset ln C/C_0 vs Time of 4-nitrophenole reduction for $MnO_x/CeO_2/C$ to measure the rate constant "k" of reaction.

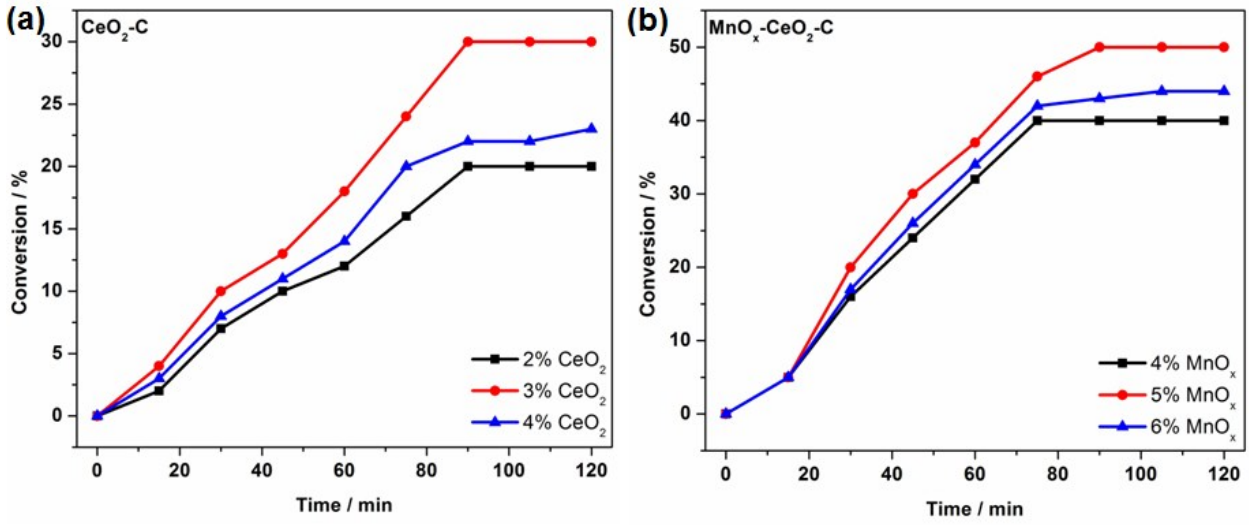

Fig. S5 (a) Conversion % vs time for Hydrogenation of styrene for CeO_2/C catalysts at varied %age of CeO_2 and **(b)** Conversion % vs time for Hydrogenation of styrene for $MnO_x/CeO_2/C$ catalysts at varied %age of MnO_x.

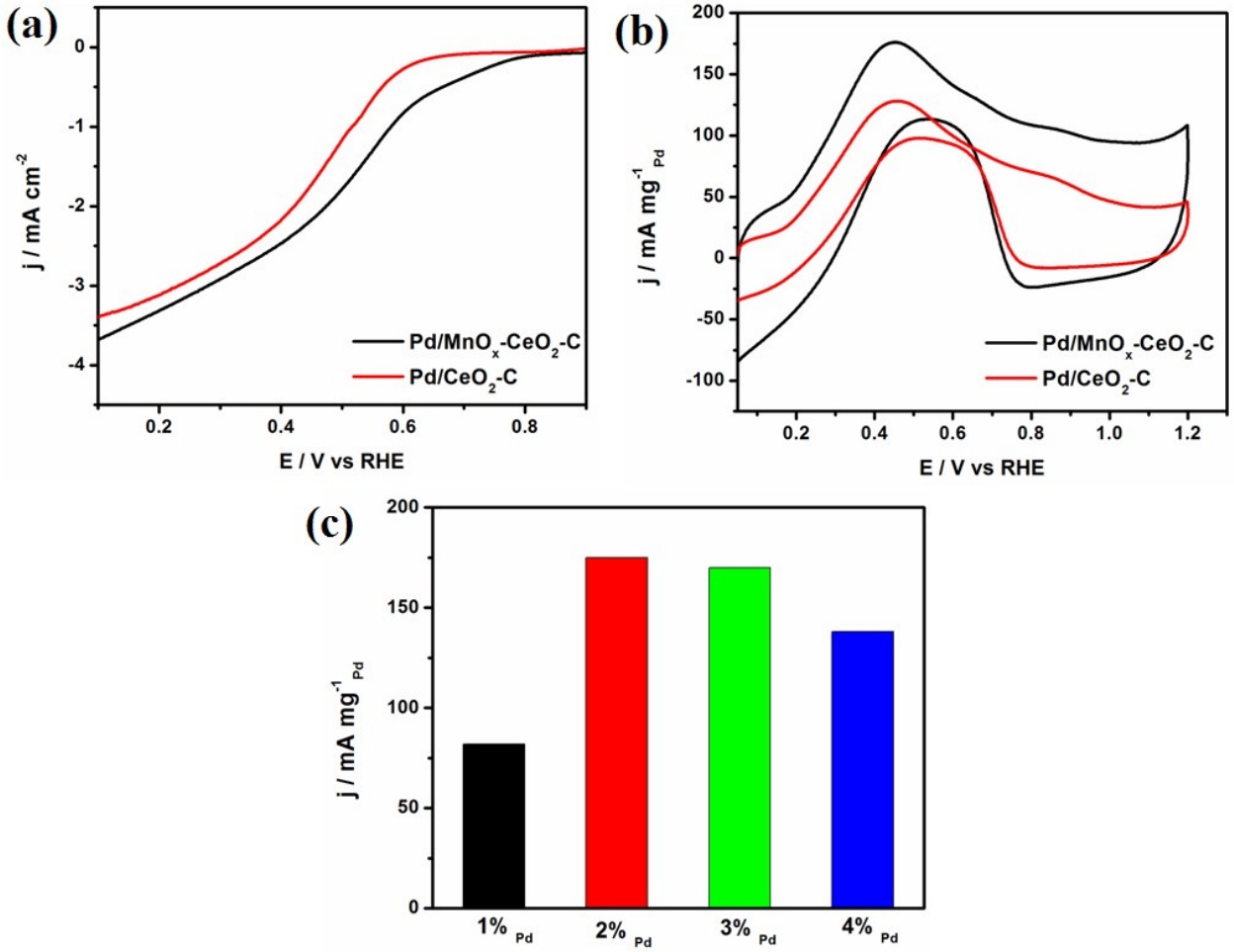

Fig. S6 (a) ORR performance comparison for the catalyst Pd/MnO_x-CeO_2-C and the catalyst (PdCeO_2-C) in the absence of MnOx in similar experimental conditions, environment with rotation of 1600 rpm, **(b)** FAOR performance comparison for the catalyst Pd/MnO_x-CeO_2-C and the catalyst (PdCeO_2-C) in the absence of MnOx in similar experimental conditions, **(c)** Current density column graph for the FAOR performance of different Pd % loadings in Pd/MnO_x-CeO_2-C catalyst to represent the optimal Pd wt% for electrochemical performance.