Supporting Information

Synergistic Effect of Interfacial Phenomenon on Enhancing Catalytic Performance of Pd Loaded MnOₓ-CeO₂-C Hetero-nanostructure for Hydrogenation and Electrochemical Reactions

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Fig. S1. Temperature-programmed reduction (TPR) spectra of (a) MnOₓ-CeO₂-C and (b) Pd/MnOₓ-CeO₂-C catalysts.
Fig. S2 4-NP absorption peak before and after addition of NaBH₄.
Fig. S3 (a) UV-absorption spectra for the reduction of 4-nitrophenol 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-nitrophenol 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 $\text{MnO}_x/\text{CeO}_2/\text{C}$ to measure the rate constant “$k$” of reaction.

**Fig. S5** (a) Conversion % vs time for Hydrogenation of styrene for $\text{CeO}_2/\text{C}$ catalysts at varied %age of $\text{CeO}_2$ and (b) Conversion % vs time for Hydrogenation of styrene for $\text{MnO}_x/\text{CeO}_2/\text{C}$ catalysts at varied %age of $\text{MnO}_x$. 
Fig. S6 (a) ORR performance comparison for the catalyst Pd/MnO\textsubscript{x}-CeO\textsubscript{2}-C and the catalyst (PdCeO\textsubscript{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\textsubscript{x}-CeO\textsubscript{2}-C and the catalyst (PdCeO\textsubscript{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\textsubscript{x}-CeO\textsubscript{2}-C catalyst to represent the optimal Pd wt% for electrochemical performance.