

Electronic Supplementary Information

MnO_x supported on TiO₂@SBA-15 nanoreactor used as an efficient catalyst for one-pot synthesis of imine by oxidative coupling of benzyl alcohol and aniline under atmospheric air

Sandip Mandal^{a*}, Sudip Maity^{a*}, Sujan Saha^a, Biplab Banerjee^b

^a Research Group of Gasification and Liquefaction, CSIR- Central Institute of Mining and Fuel Research (DC), PO: FRI, Dhanbad - 828108, India

^b Department of Material Science, Indian Association for Cultivation of Science, Jadavpur, Kolkata - 700032, India

***Corresponding author: sandip.chemist09@gmail.com; sudip_maity@yahoo.com; Tel: (+91)-326-2388363; Fax: (+91)-326-2381113**

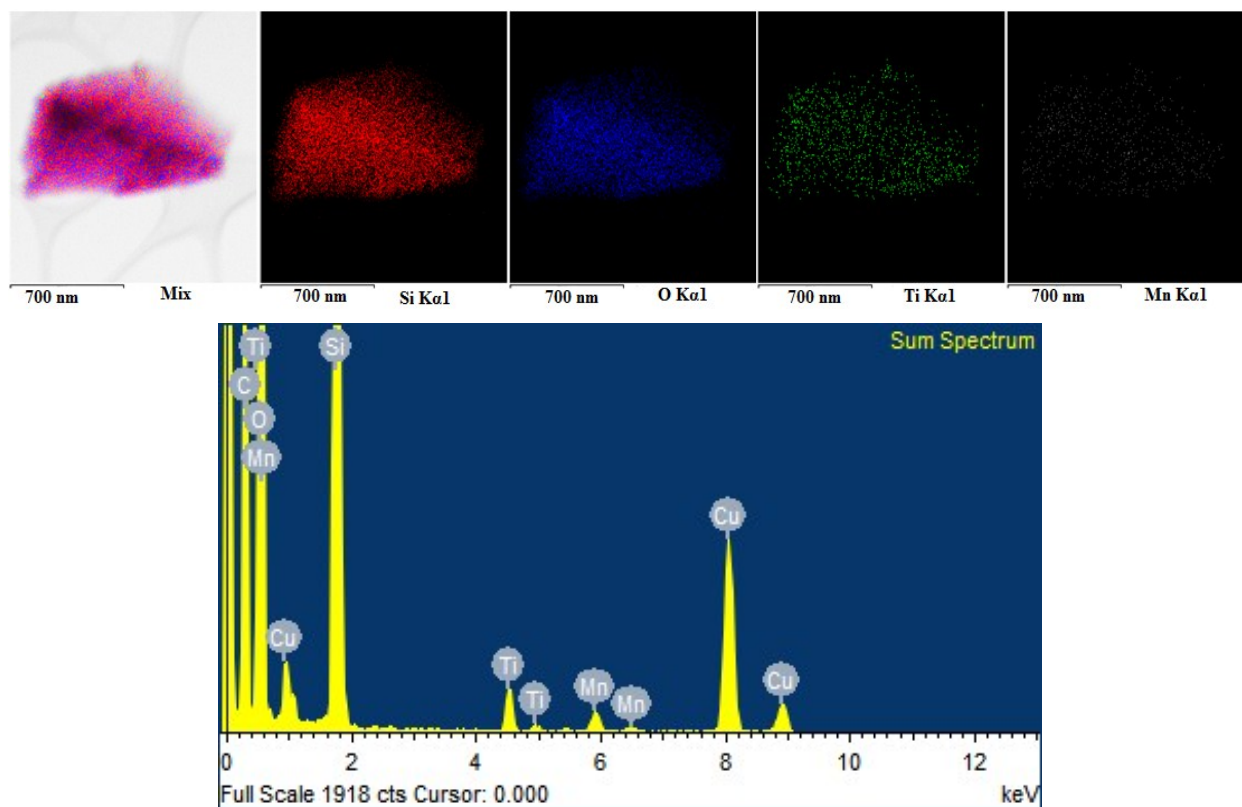


Fig. S1: HAADF-STEM image with elemental analysis of MnO_x/MnO₂@SBA-15 (7.5 wt%) MnO_x & 5 wt% TiO₂

Fourier Transform Infrared Spectroscopic (FT-IR) analysis: The FT-IR spectrum of the prepared catalysts with different metal loading are shown in **Fig. S2**. Two intense peaks are observed at around 800 cm⁻¹ and 1100 cm⁻¹ which indicate symmetric and asymmetric stretching vibration of Si-O-Si bridges present in SBA-15 material. A small intense peak at around 960 cm⁻¹ indicates the stretching vibration of Si-OH group. There is no peak ~ 540 cm⁻¹, which suggests that no “Ti-O-Mn” bonds (Materials Science and Engineering B 175 (2010) 48–55) have been formed hence it may be concluded that only individual (separate) phases of MnO_x and TiO₂ are formed in the present study.

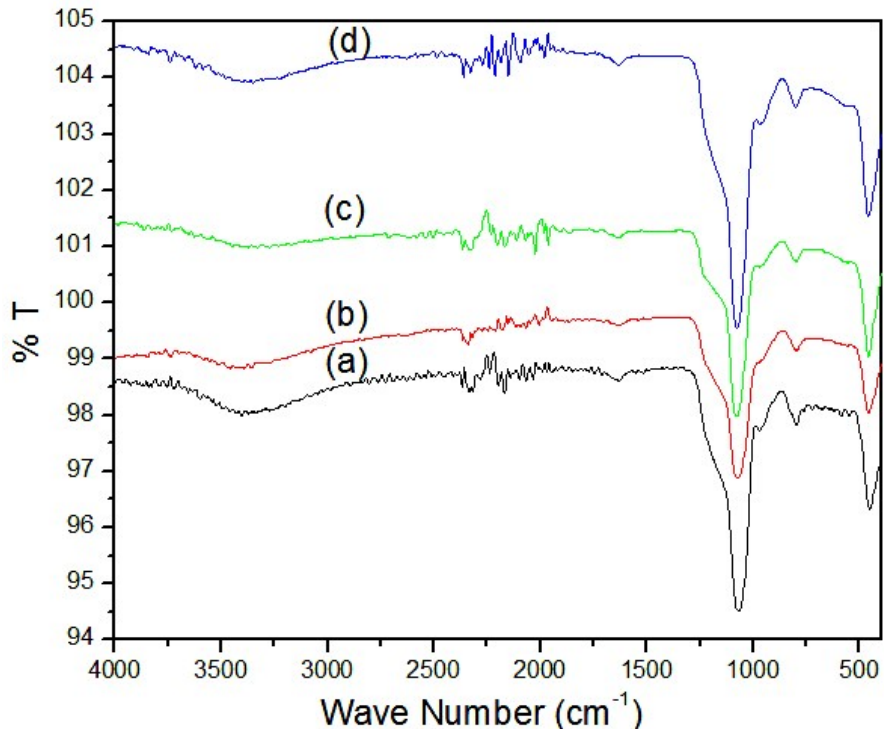


Fig. S2: Fourier Transform Infrared (FT-IR) spectrum of (a) $\text{TiO}_2/\text{KIT-6}$ (5 wt% TiO_2), (b) $\text{MnO}_x/\text{TiO}_2@\text{SBA-15}$ (5 wt% MnO_x & 5 wt% TiO_2) (c) $\text{MnO}_x/\text{TiO}_2@\text{SBA-15}$ (7.5 wt% MnO_x & 5 wt% TiO_2), (d) $\text{MnO}_x/\text{TiO}_2@\text{SBA-15}$ (10 wt% MnO_x & 5 wt% TiO_2)

S3: Hot filtration study: To examine the leaching of active component of catalyst, hot filtration study was carried out. In this procedure anhydrous toluene (2 mL), benzyl alcohol (1 mmol), aniline (1 mmol) and catalyst (0.1 g) was taken in a 50 mL round bottomed flask and stirred [300 rpm] continuously for 2 h at 80 °C temperature under atmospheric condition (dry air balloon). After 2 h the reaction mixture was centrifuged in hot condition and small portion of supernatant liquid was taken for GC analysis and the remaining portion of supernatant liquid was further taken in a 50 mL round bottomed flask and stirred continuously for 22 h at 80 °C under atmospheric air (dry air balloon). After 22 h the reaction mixture was taken for GC analysis.

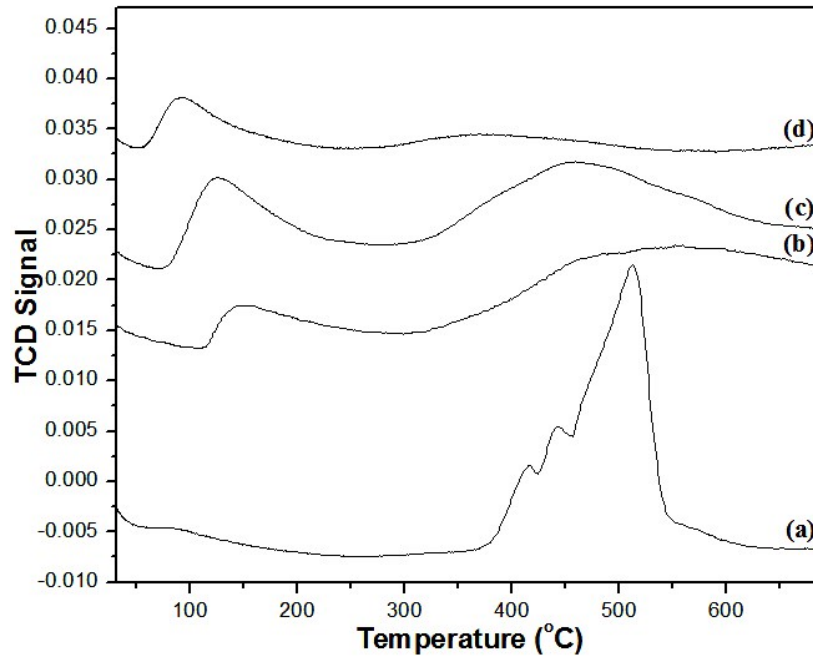


Fig. S4: O₂-TPO profile of (a) MnO_x/TiO₂ (7.5 wt% MnO_x), (b) MnO_x/SBA-15 (7.5 wt% MnO_x), (c) MnO_x/TiO₂@SBA-15 (7.5 wt% MnO_x & 5 wt% TiO₂), (d) TiO₂@SBA-15 (5 wt% TiO₂)