

Supporting Information

A novel Ru/TiO₂ hybrid nanocomposite catalyzed photoreduction of CO₂ to methanol under visible light

Pawan Kumar^a, Chetan Joshi^a, Nitin Labhsetwar^b, Rabah Boukherroub^c, and Suman L. Jain^{a*}

^aChemical Sciences Division, CSIR-Indian Institute of Petroleum, Dehradun India 248005

^bEnvironmental Materials Division, CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur-India,

^c Institut d'Electronique, de Microélectronique et de Nanotechnologie (IEMN)UMRCNRS 8520, Université Lille1, Avenue Poincaré-BP60069, 59652 Villeneuve d'Ascq Cédex, France

suman@iip.res.in

Fig: S1 STEM Elemental Mapping and HR-TEM EDX Pattern of Ru(bpy)₃/TiO₂ a) showing image of area scanned; b) Titanium; c) Oxygen; d) Ruthenium.

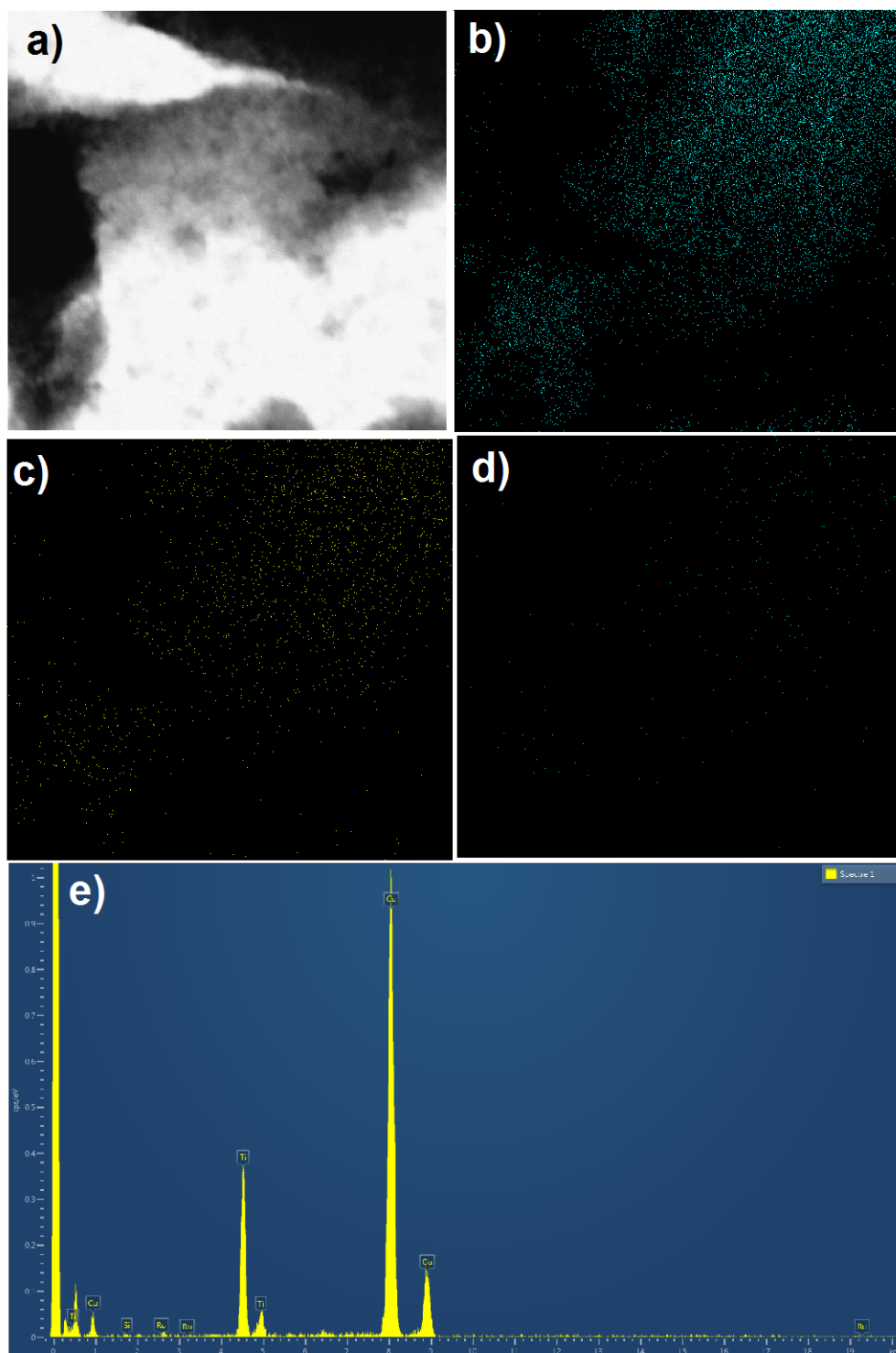


Fig: S2 GC chromatogram of reaction product after 24 h of visible light irradiation using $\text{Ru}(\text{bpy})_3/\text{TiO}_2$ as catalyst in DMF: H_2O :TEA (3:1:1)

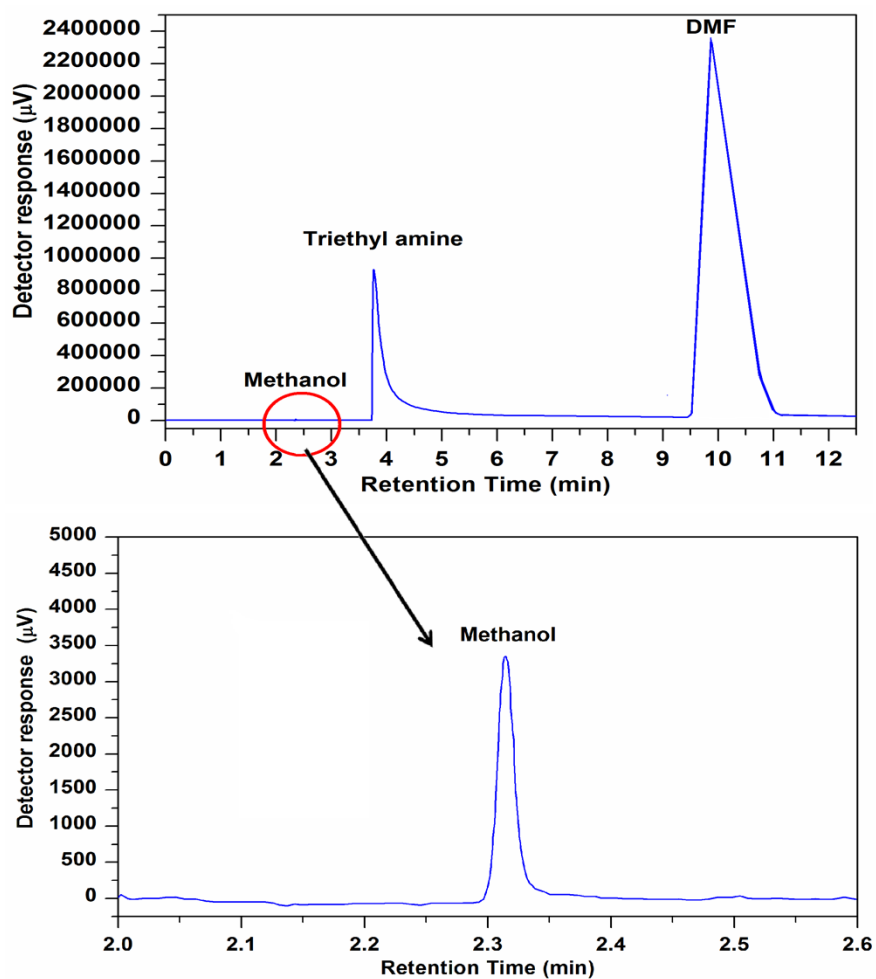


Fig. S3: GC chromatogram of reaction product after 24 h of visible light irradiation using $\text{Ru}(\text{bpy})_3/\text{TiO}_2$ as catalyst in $\text{CH}_3\text{CN}:\text{H}_2\text{O}:\text{TEA}$ (3:1:1)

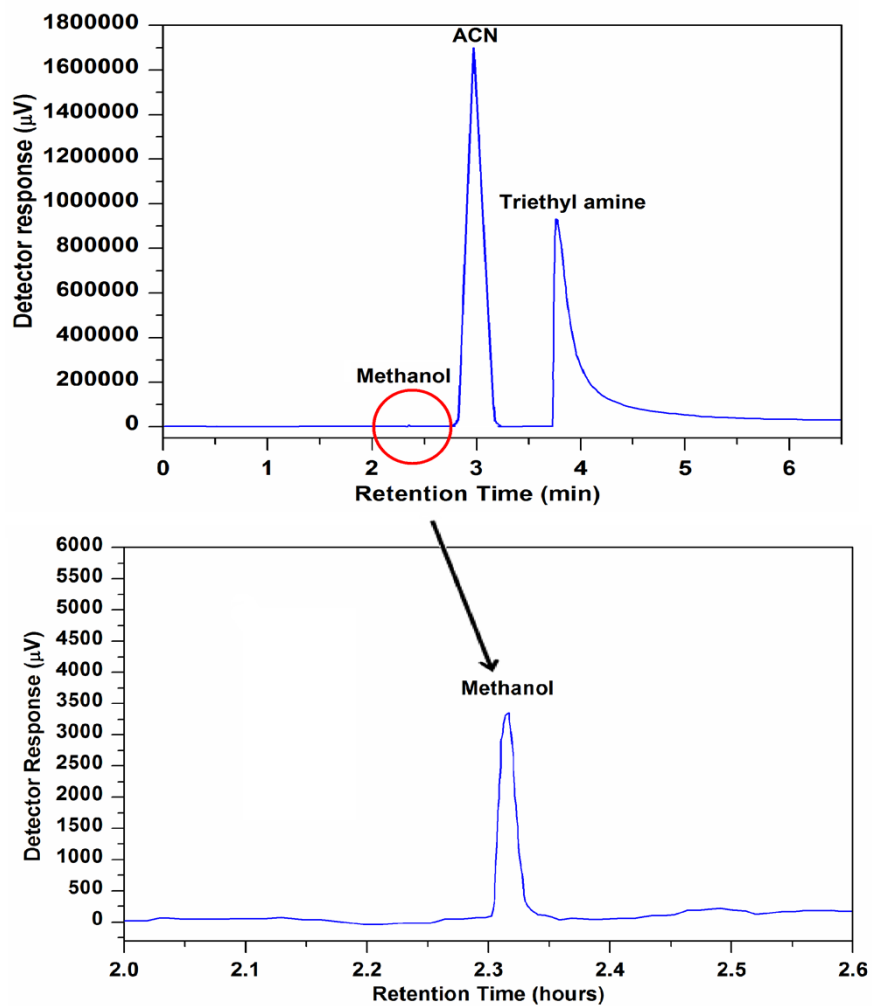


Fig. S4: Calibration curve for quantitative determination of methanol

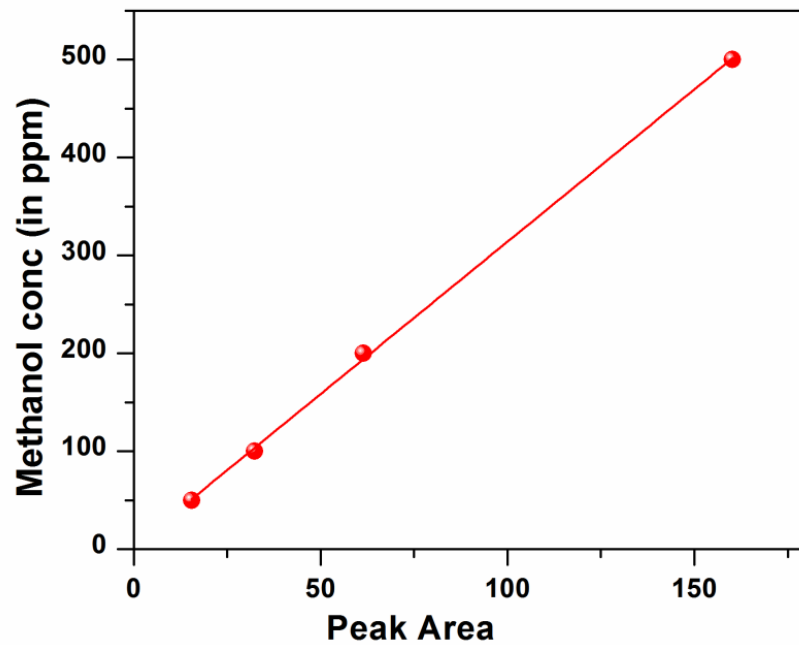


Fig. S5: Spectral power distribution of LED lamp

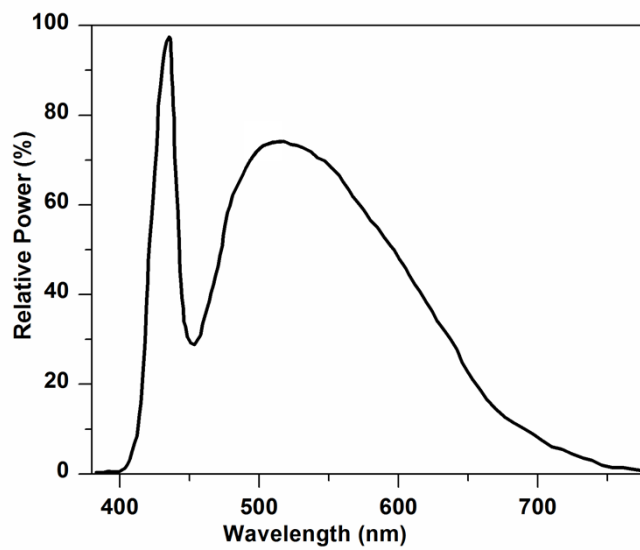


Fig. S6: GC Mass spectra of reaction product of CO₂ reduction after 24 h of visible light irradiation using Ru(bpy)₃@TiO₂ as catalyst

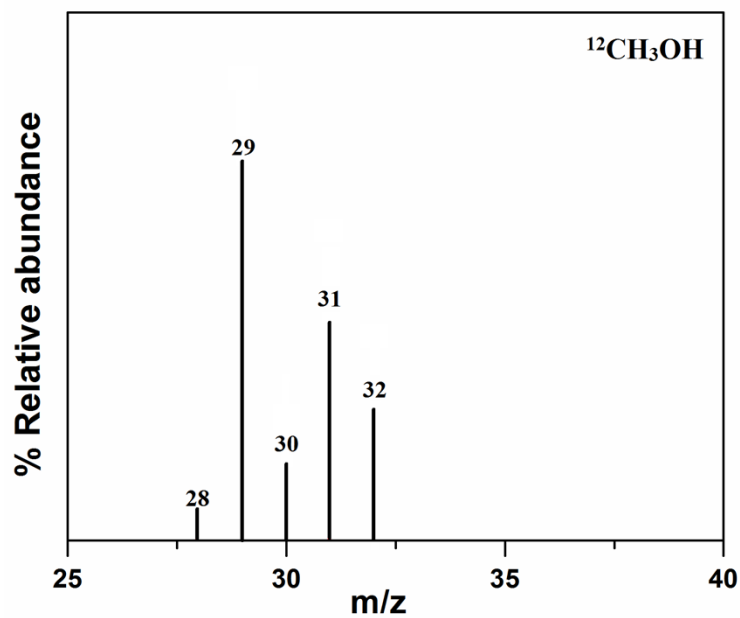


Fig. S7: GC Mass spectra of reaction product of ¹³CO₂ reduction after 24 ho of visible light irradiation using Ru(bpy)₃@TiO₂ as catalyst.

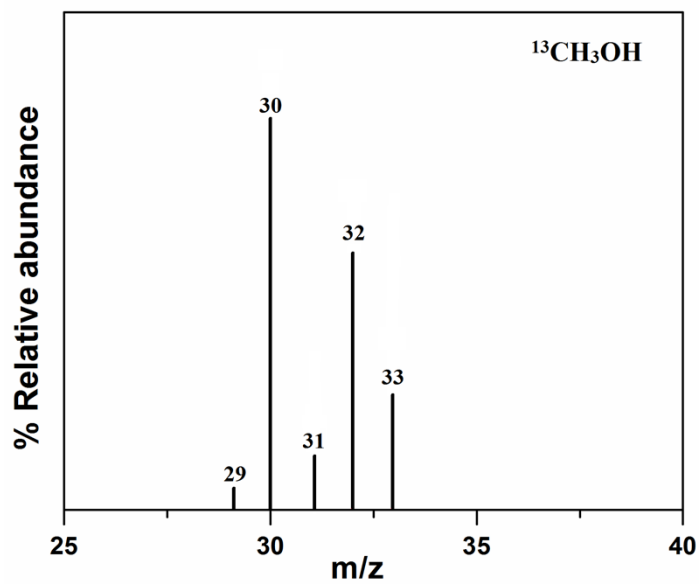


Fig. S8 a) FE-SEM image b) FE-SEM EDX c) and d) elemental mapping by FE-SEM of recycled catalyst

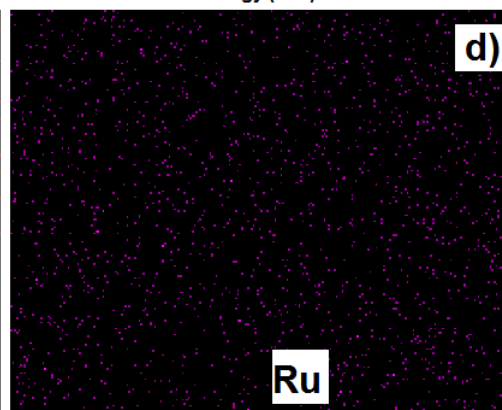
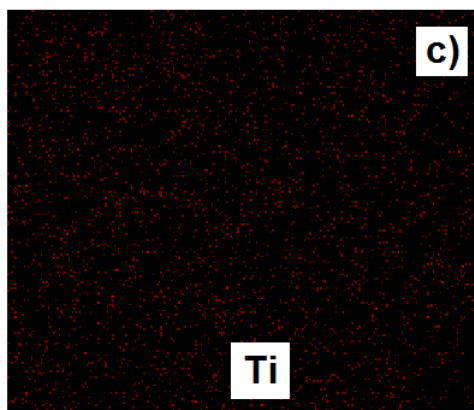
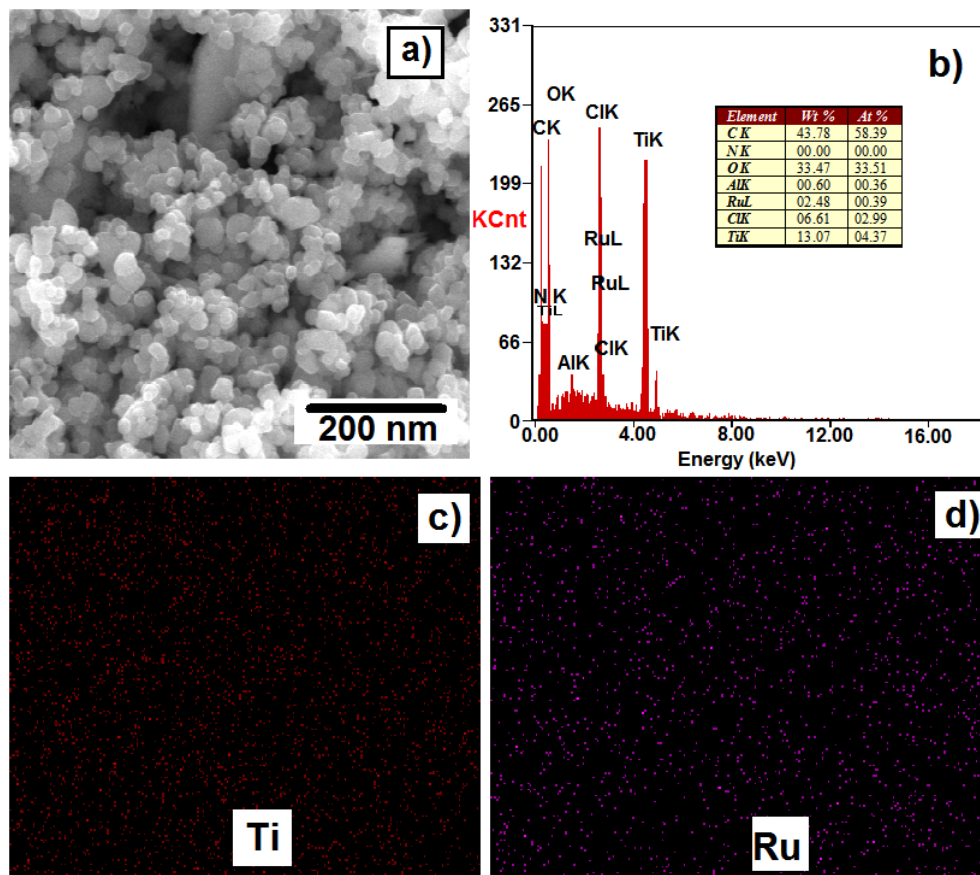


Fig. S9 FTIR spectra of fresh and recycled catalyst.

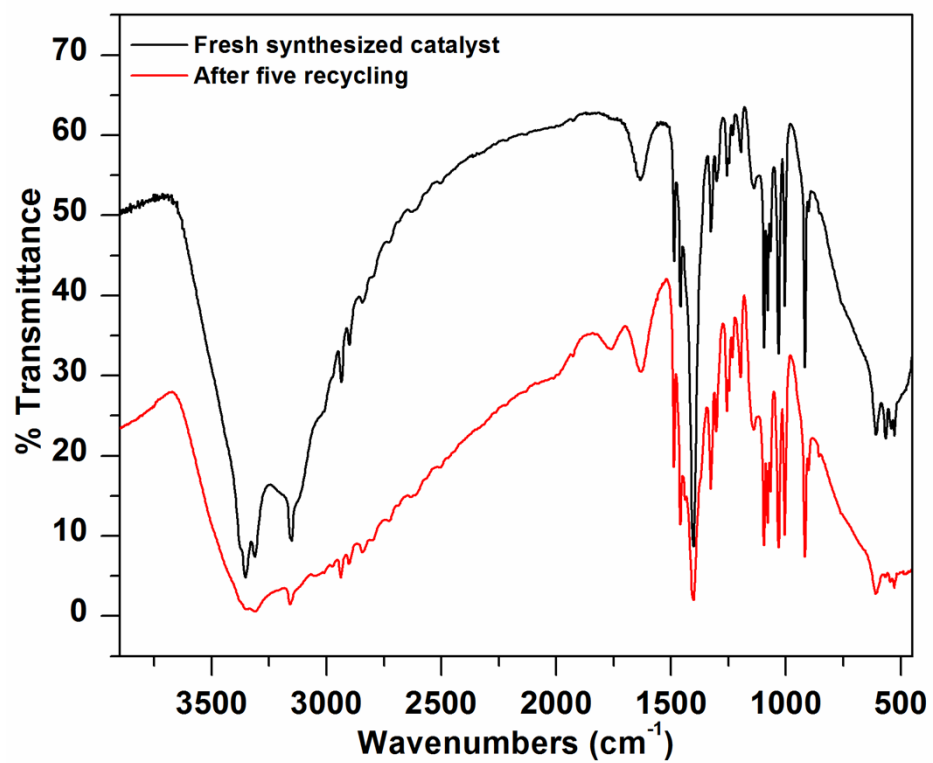


Fig. S10 XRD diffraction Pattern of recycled catalyst.

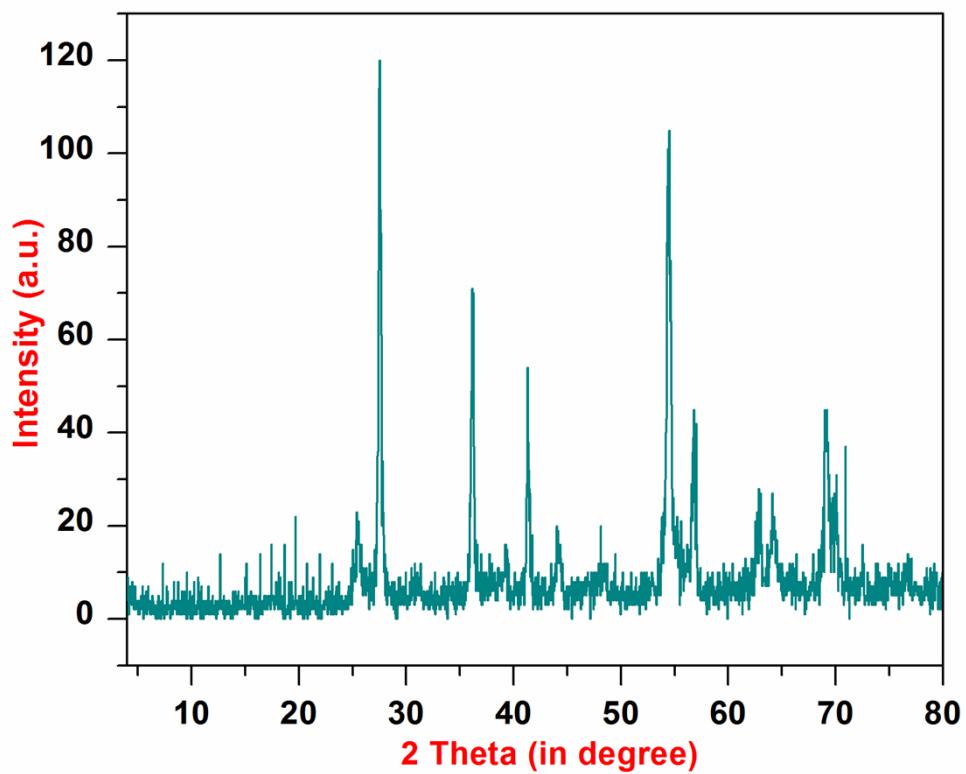


Fig. S11 UV-Vis spectra of in situ Ru(bpy)₃/TiO₂ catalyst after five recycling experiments

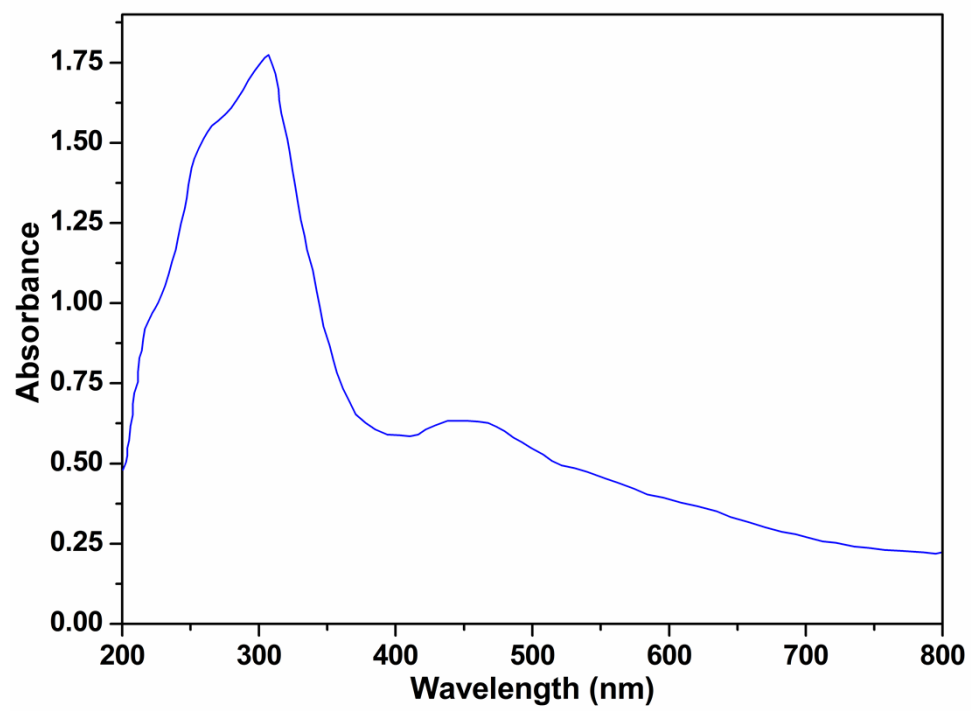


Fig. S12 Effect of ruthenium loading in hybrid $\text{Ru}(\text{bpy})_3/\text{TiO}_2$ catalyst on the methanol yield.

