

Electronic Supplementary Information

Advances in photocatalytic NO_x abatement through the use of Fe₂O₃/TiO₂ nanocomposites

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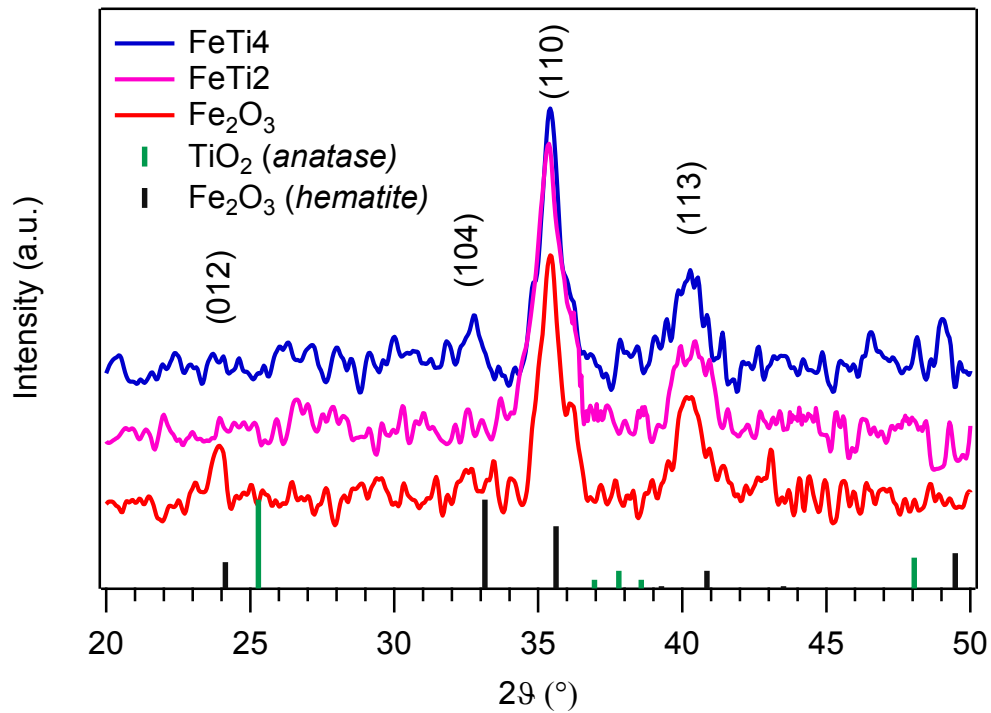


Fig. S1. XRD diffraction patterns for bare Fe₂O₃ and for Fe₂O₃-TiO₂ nanocomposites. Peak positions for *hematite* [Pattern N° 33-0664, JCPDS (2000)] and *anatase* [Pattern N° 021-1272, JCPDS (2000)] are marked by vertical bars.

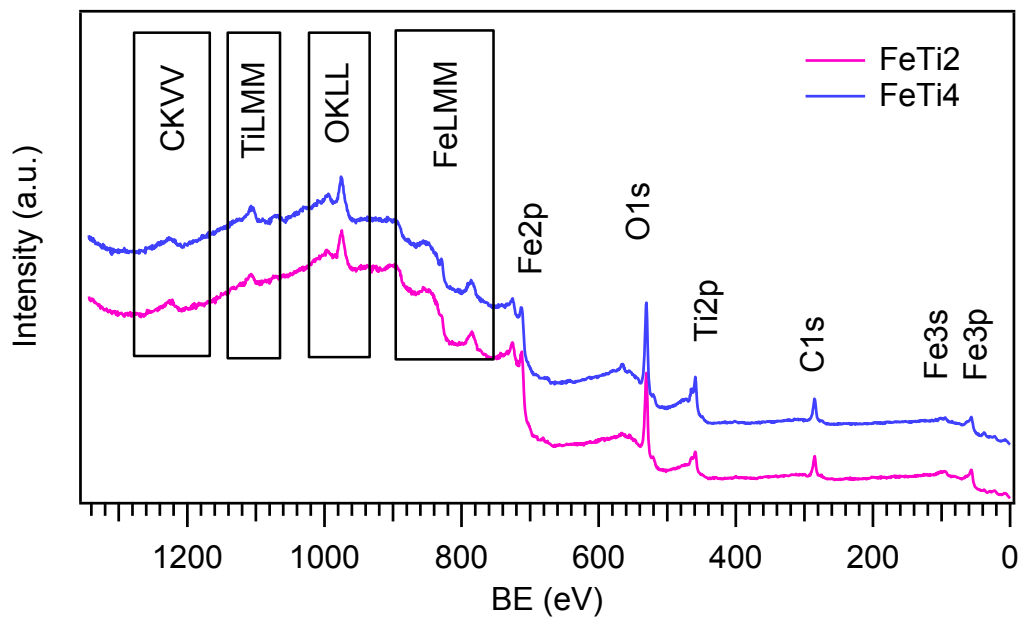


Fig. S2. Surface XPS survey spectra of Fe₂O₃-TiO₂ nanocomposites.

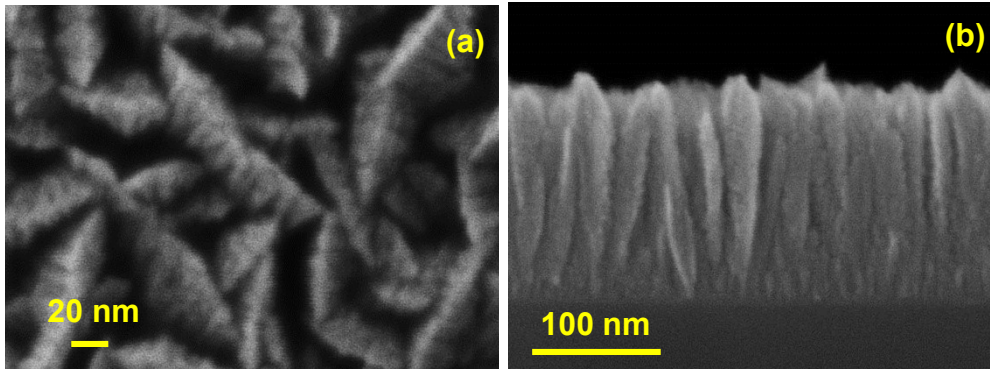


Fig. S3. Plane view (a) and cross sectional (b) FE-SEM micrographs for a bare Fe_2O_3 deposit.

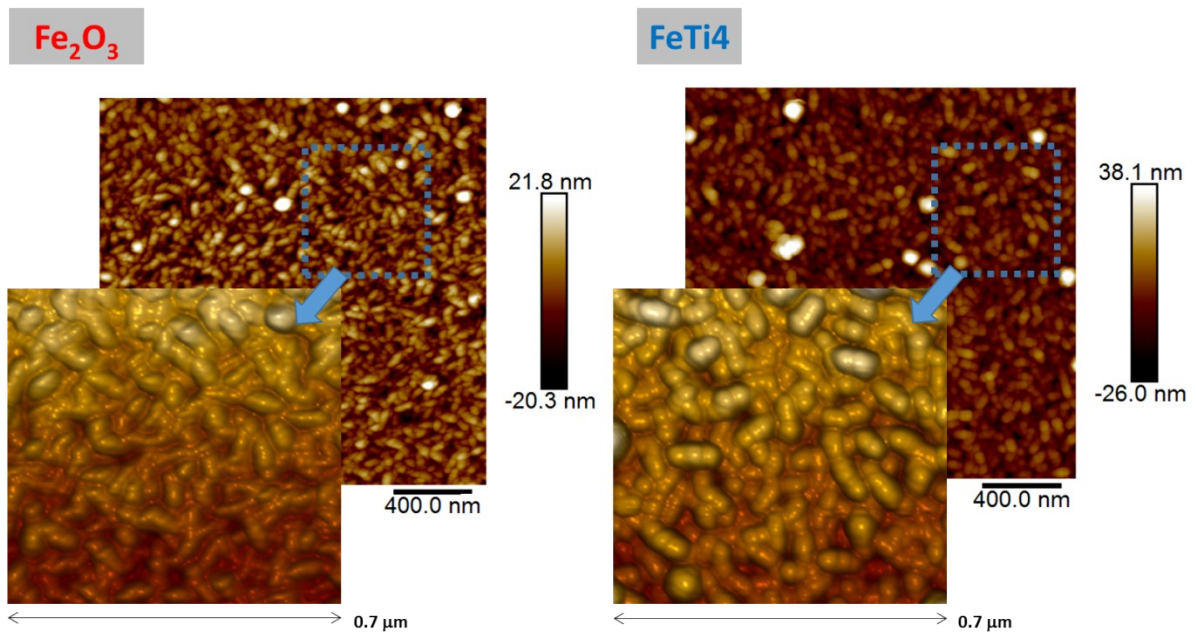


Fig. S4. Representative AFM micrographs for bare Fe_2O_3 and FeTi_4 specimens. Calculated root-mean-square (RMS) roughness values for Fe_2O_3 and FeTi_4 samples are 74 and 84 nm, respectively.

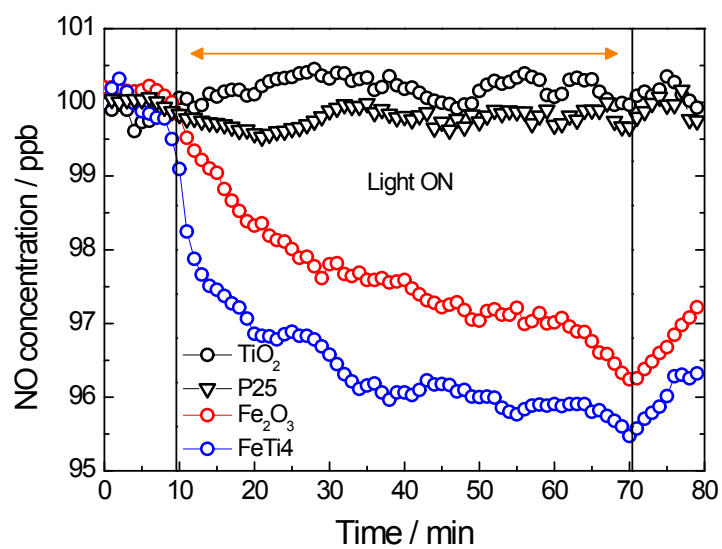


Fig. S5. Concentration profiles obtained for P25, TiO₂, Fe₂O₃ and FeTi4 samples during the photochemical degradation of gaseous NO under Vis light irradiation.

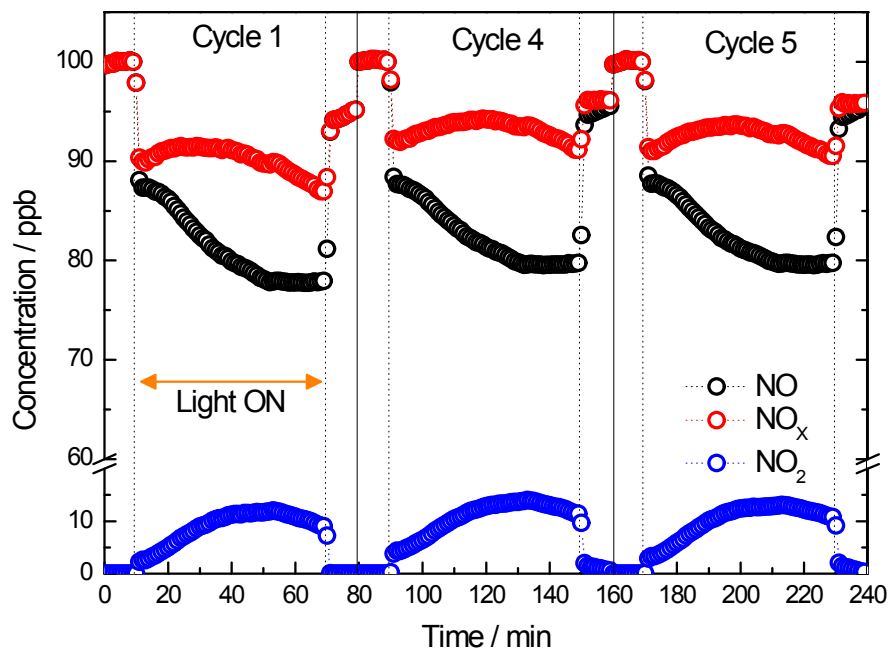


Fig. S6. Nitrogen oxide concentration profiles obtained for FeTi4 specimen under different utilization cycles.

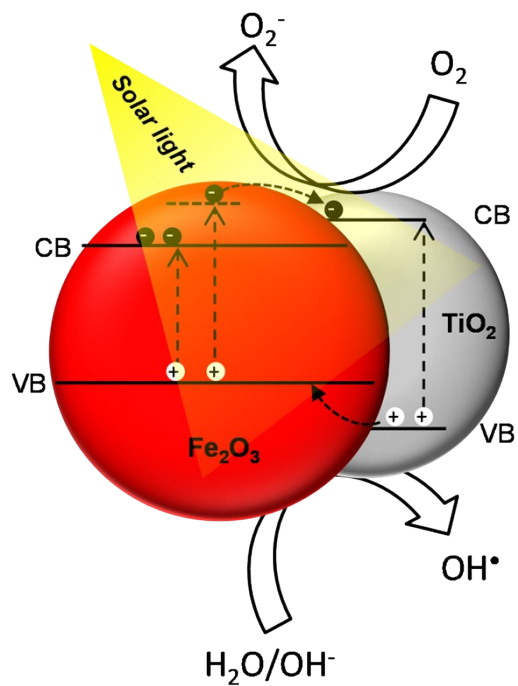


Fig. S7. Simplified representation of the mechanism for PC activity enhancement occurring in Fe₂O₃/TiO₂ nanocomposites.

IR analysis

Infrared (IR) spectra were recorded by means of a Perkin Elmer FTIR System Spectrum BX, operating in transmittance mode at normal incidence.

The assignment of IR bands pertaining to Fig. S8 spectra is the following.

The band around 1640 cm^{-1} corresponds to O–H bending vibrations, implying the presence of adsorbed water (Fig. S8a). The bands marked in Fig. S8b were assigned basing on to the previously reported information on the interaction of nitrogen oxides with TiO_2 .¹⁻³ The bands located at 1529 , 1506 and 1487 cm^{-1} correspond to stretching vibrations of nitrate species^{1, 2, 4} whereas those at 1417 and 1261 cm^{-1} are ascribed to nitrite ones.^{2, 4} The band at 1710 cm^{-1} can be tentatively assigned to adsorbed NO_2 .³ A more detailed attribution of IR bands attributed to N–O stretching vibrations of surface nitrate (NO_3^-) and nitrite (NO_2^-) species is a difficult task, since $\nu(\text{N–O})$ of different NO_3^- and NO_2^- species fall in the same $1700\text{--}1000\text{ cm}^{-1}$ interval and their IR bands are strongly overlapped.¹

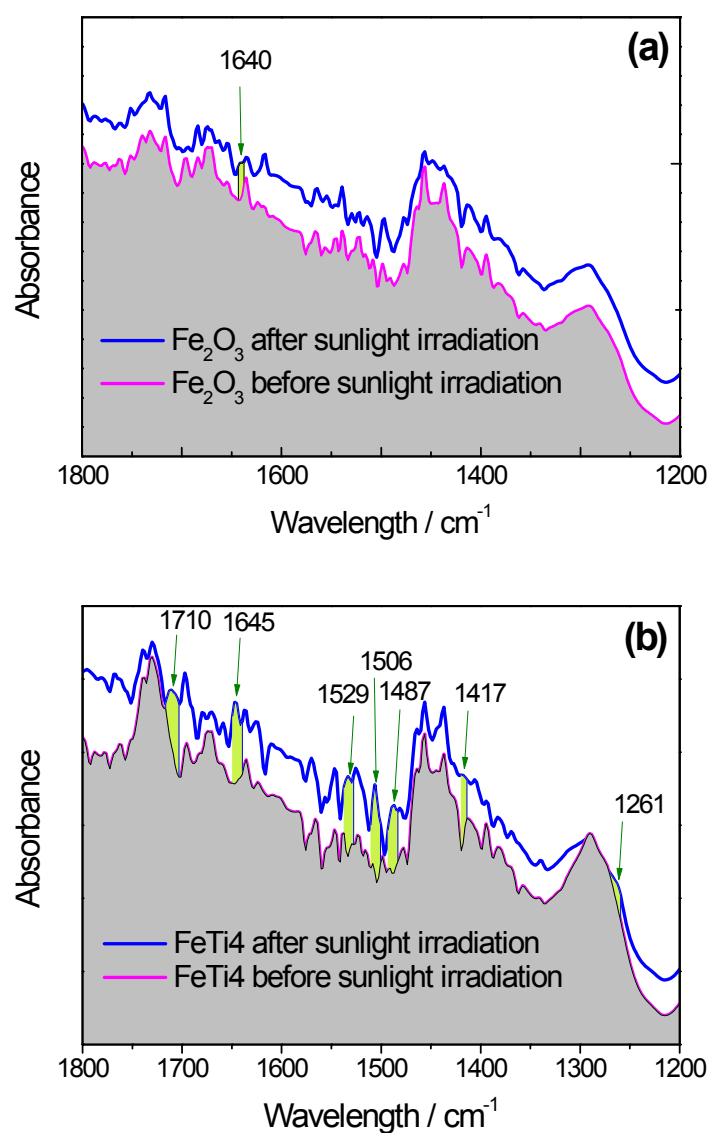


Fig. S8. IR spectra in the 1800 – 1200 cm^{-1} range of (a) Fe_2O_3 and (b) FeTi4 samples before and after NO_x degradation tests.

References

1. R. V. Mikhaylov, A. A. Lisachenko, B. N. Shelimov, V. B. Kazansky, G. Martra and S. Coluccia, *J. Phys. Chem. C*, 2013, **117**, 10345-10352.
2. J. Sá and J. A. Anderson, *Appl. Catal. B*, 2008, **77**, 409-417.
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