

Supplement to: High-quality Fe-doped TiO₂ films with superior visible-light performance

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BET measurement

The total surface area of the films was measured by the Brunauer-
10 Emmett-Teller (BET) method using an Autosorb-1
(Quantachrome, US) BET setup with Kr as adsorbate. Krypton
gas was used as adsorbate since it has a relative low vapour
pressure which allows measuring very small total surface areas.
Prior to the measurement the samples were degassed at 400 K for
15 at least 8 h in vacuum. The Kr adsorption isotherm was then
measured at 77 K. Multipoint measurements (see Fig. S1) in the
pressure range of $0.05 < P/P_0 < 0.25$ were used to calculate the
specific surface area.¹ The vapor pressure (P_0) of Kr at 77 K was
set to 350 Pa for all measurements. The cross-sectional area of a
20 Kr molecule is 0.205 nm^2 and the apparent surface area of an as-
prepared film is 78.5 mm^2 .

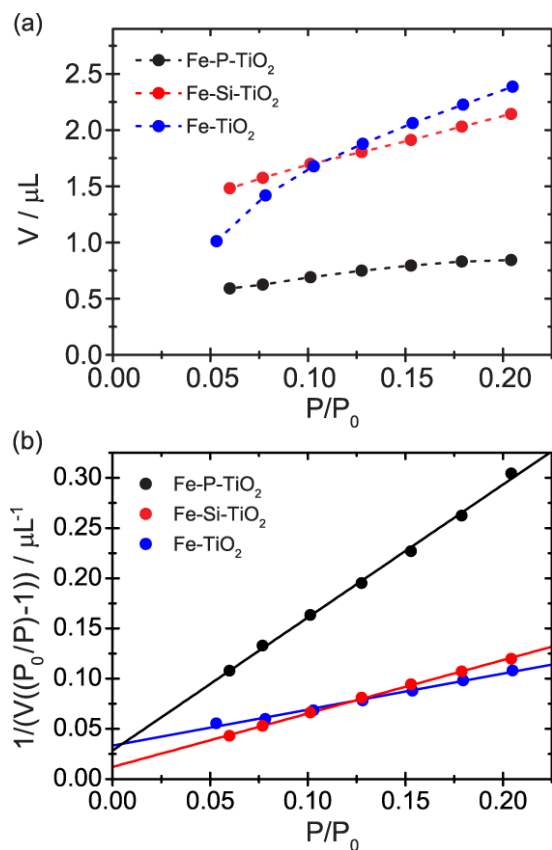


Figure S1. BET surface area measurement of the Fe-P-TiO₂, Fe-Si-TiO₂,
and Fe-TiO₂ film: raw data (a) and linear fit in order to extract the total
25 surface area (b). The fitting parameters are listed in Tab. S1.

Table S1 lists the values obtained for slope and intercept from the
linear fitting to the data in Fig. S1(b) as well as the calculated
values for the absolute and the specific surface area and the heat
of condensation.

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Table S1. BET surface area analysis of the Fe-P-TiO₂, Fe-Si-TiO₂, and
Fe-TiO₂ films. Slope and intercept are obtained by linear fitting of the
data in Fig. S1(b).

Catalyst	Fe-P-TiO ₂	Fe-Si-TiO ₂	Fe-TiO ₂
Slope (μL ⁻¹)	1.325±0.028	0.534±0.007	0.358±0.015
Intercept (μL ⁻¹)	0.028±0.004	0.012±0.001	0.033±0.002
Total surface area (cm ²)	41±1	101±1	140±6
Specific surface area (m ² /m ²)	52±1	128±2	179±8
Heat of condensation (kJ/mol)	2.5±0.1	2.4±0.1	1.6±0.1

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MB adsorption on Fe-TiO₂

An aqueous methylene blue (MB) solution (4 μM) was used for
the photo-decomposition test under blue light irradiation. A
continuously analysing UV-vis spectrometer setup was utilized to
quantify the MB concentration as function of time. Prior to
40 irradiation the sample was placed in the solution and kept in dark
for at least 1 h until the MB concentration stabilised. During that
time usually a decrease in MB concentration was observed (see
Fig. S2). We assign this decrease to MB adsorption on the sample
45 surface and on all other surfaces of the equipment in contact with
the solution, *i.e.*, the beaker, the tubing and the cuvette.

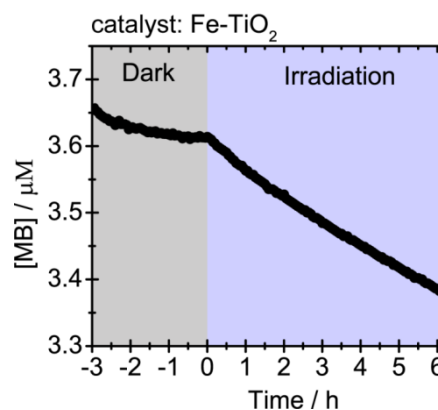


Figure S2. The concentration of MB in an aqueous solution in the dark
and upon irradiation as a function of time.

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Notes and references

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1. S. Brunauer, P. H. Emmett, E. Teller, *J. Am. Chem. Soc.*, 1938, **60**,
309.