

# Figures

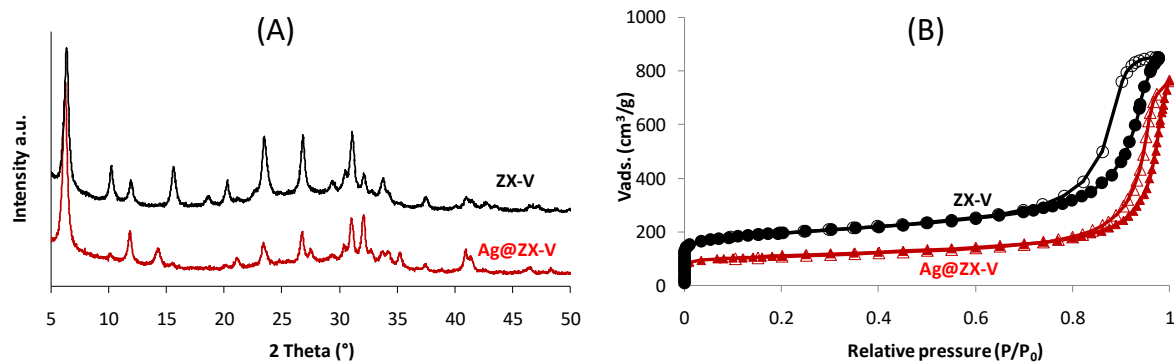
Photo-assisted SCR over highly dispersed silver sub-nanoparticles in zeolite under visible light: an *Operando* FTIR study

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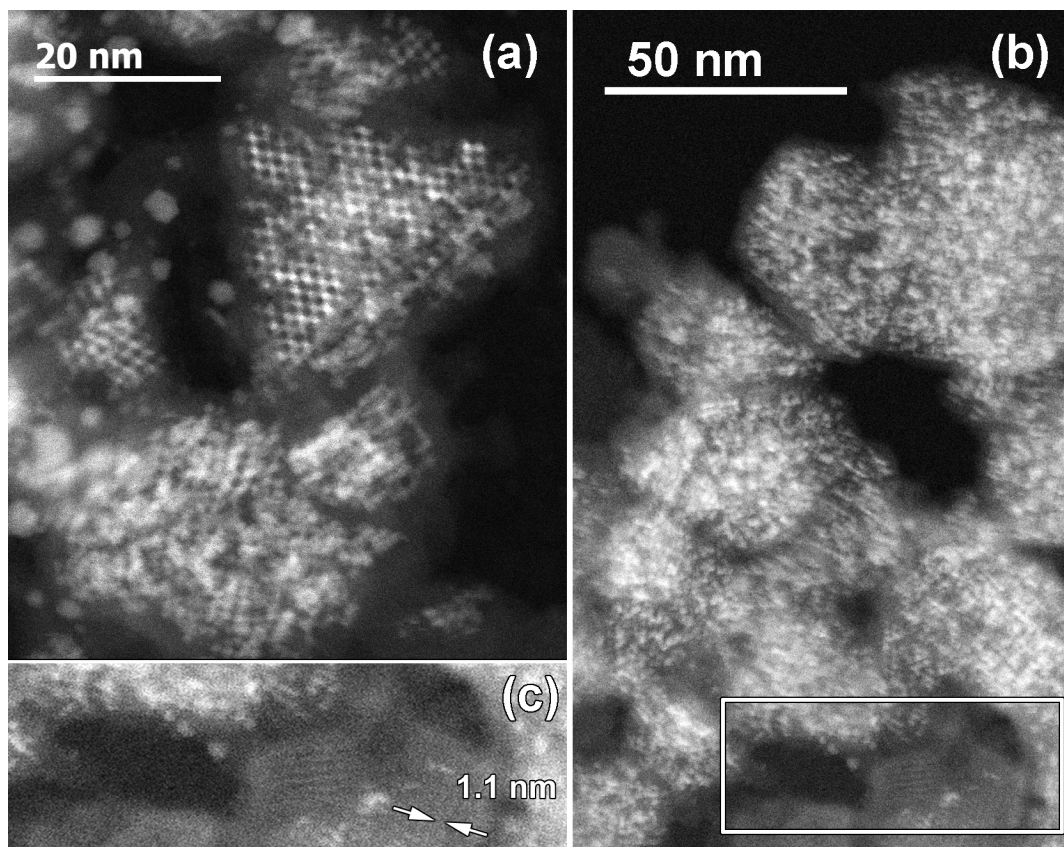
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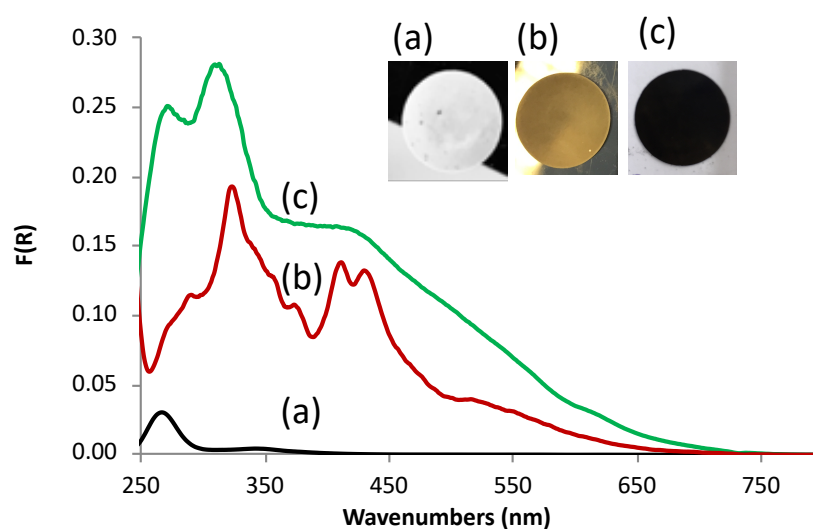
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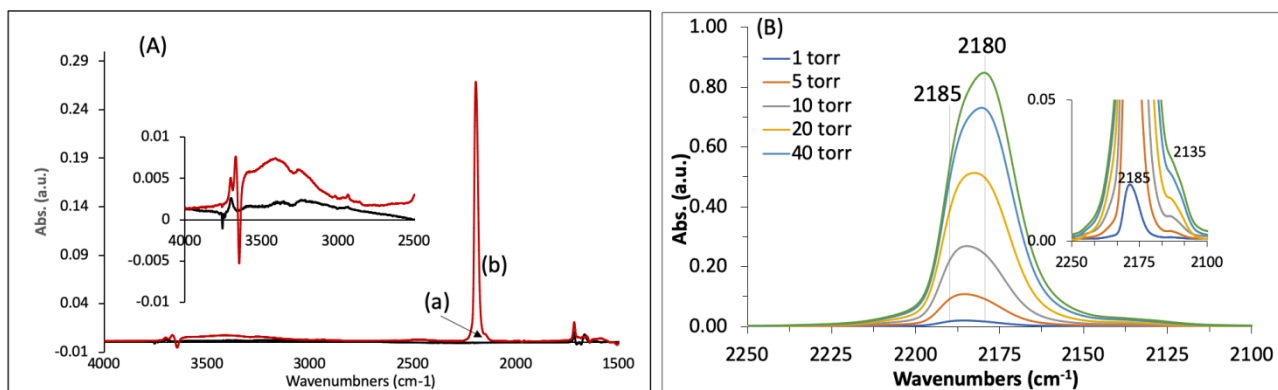
**Figure 1.** (A) Powder X-ray diffractograms (PXRD) and (B) Nitrogen adsorption (closed symbols) and desorption (open symbols) isotherms of ZX-V and Ag@ZX-V samples.



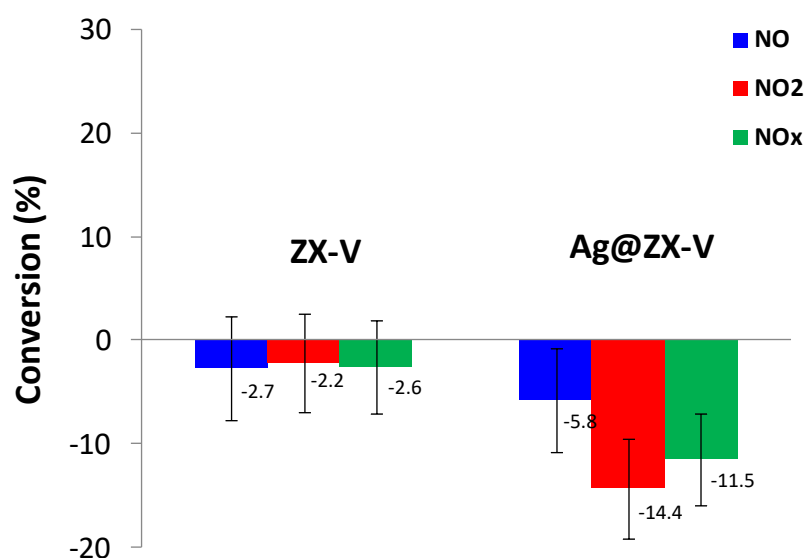
**Figure 2.** (a) HAADF-STEM images of Ag@ZX-V nanoparticle close to [001] zone axis. Triangle shape and Ag filled with an evident hexagonal arrangement of the channels. (b) HAADF-STEM image of Ag@ZX-V in the presence of non-loaded FAU nanoparticle marked by a white rectangle. The contrast is very low due to the presence only relatively light elements in zeolite (Si, O). (c) Enlargement image of selected in (b) non-loaded FAU nanoparticle with resolved lattice plains.



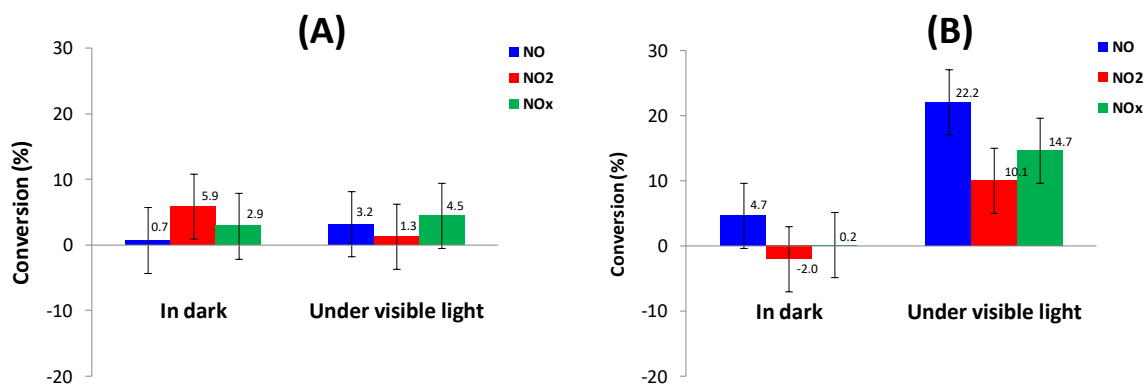
**Figure 3.** DR-UV-Vis spectra of (a) ZX-V, (b) as prepared Ag@ZX-V and (c) Ag@ZX-V activated at 150°C under Ar samples. Insert: the images of the pellets of the corresponding samples.



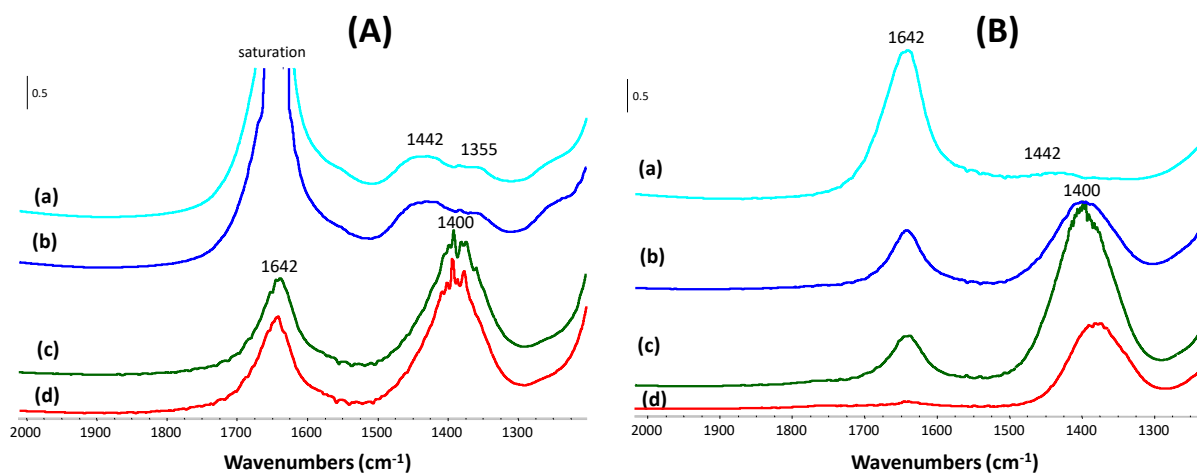
**Figure 4.** (A) IR spectra of ZX-V and Ag@ZX-V under 10 torr of CO. The spectra are subtracted from the spectra of the activated samples under vacuum (before CO adsorption). Inset: zoom on the IR spectra in the vibration region of 4000-2500  $\text{cm}^{-1}$ . (B) Evolution of the band intensities of adsorbed CO on Ag@ZX-V.



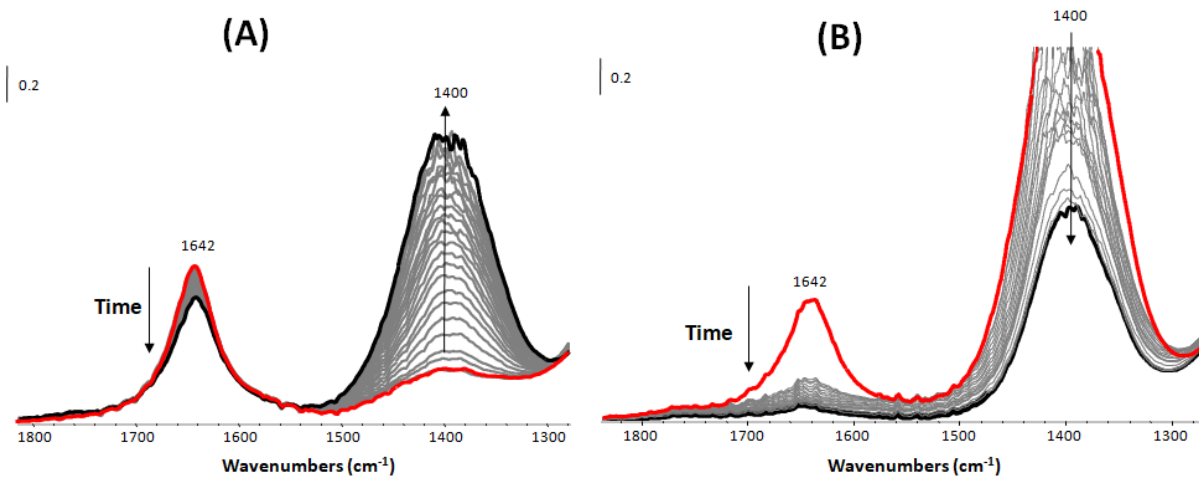
**Figure 5.** NO<sub>x</sub> conversions over ZX-V and Ag@ZX-V under visible light for a room temperature photo-assisted SCR-NH<sub>3</sub> reaction. The negative values correspond to an increase in the corresponding gas. The NO<sub>x</sub> values at the steady state before irradiation are used as references. Uncertainty estimated at 5 %. Reaction conditions:  $m_{\text{cat}}=20$  mg; Lamp Xe;  $\lambda >390\text{nm}$ ;  $T=25^\circ\text{C}$ ; gas mixture: 150 ppm of NO<sub>x</sub>, 150 ppm of NH<sub>3</sub>, 667 ppm of CO, 5 % CO<sub>2</sub>, 10 % O<sub>2</sub>, 50 ppm of HC and 2 % of water; Total flow= 31  $\text{cc}\cdot\text{min}^{-1}$ .



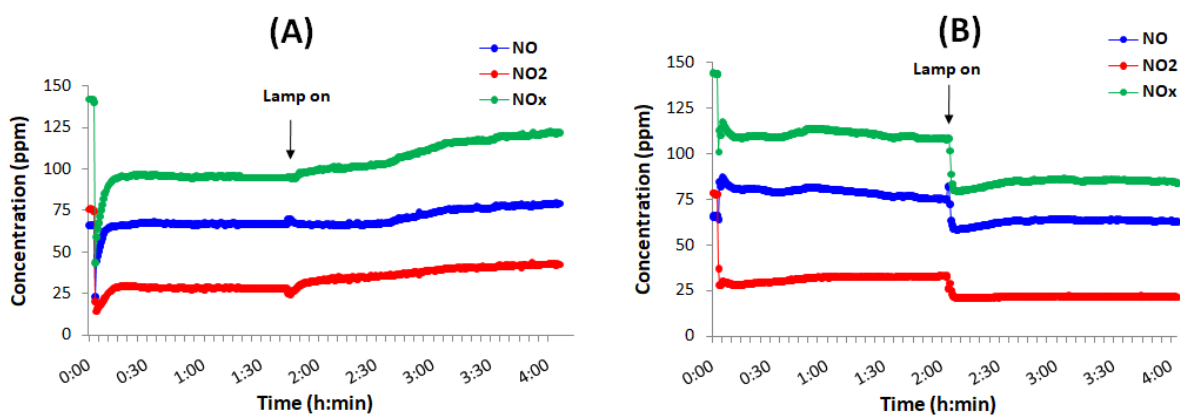
**Figure 6.** NO<sub>x</sub> conversions over (A) ZX-V and (B) Ag@ZX-V samples during the photo-assisted SCR-NH<sub>3</sub> reaction in the dark and under visible light at T = 150 °C. The NO<sub>x</sub> values at the steady state before irradiation at 25 °C are used as references. Uncertainty estimated at 5 %. Reaction conditions: m<sub>cat</sub>=20 mg; Lamp Xe; λ>390 nm; irradiance =110 mW/cm<sup>2</sup>; T=25°C; gas mixture: 150 ppm of NO<sub>x</sub>, 150 ppm of NH<sub>3</sub>, 667 ppm of CO, 5 % CO<sub>2</sub>, 10 % O<sub>2</sub>, 50 ppm of HC and 2 % of water; Total flow = 31 cc.min<sup>-1</sup>.



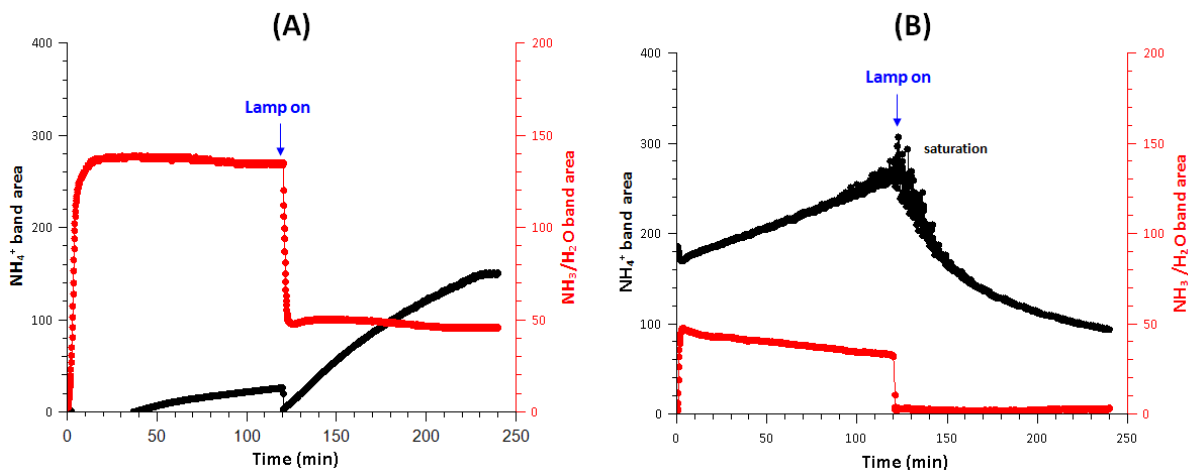
**Figure 7.** IR spectra of (A) ZX-V and (B) Ag@ZX-V recorded at the steady-state of photo-assisted SCR-NH<sub>3</sub> reaction at RT in dark (a), RT under visible irradiation (b) and at 150 °C in dark (c) and under visible irradiation (d). Reaction conditions: m<sub>cat</sub>= 20 mg; Lamp Xe; λ >390nm; irradiance =110 mW/cm<sup>2</sup>; gas mixture: 150 ppm of NO<sub>x</sub>, 150 ppm of NH<sub>3</sub>, 667 ppm of CO, 5 % CO<sub>2</sub>, 10 % O<sub>2</sub>, 50 ppm of HC and 2 % of water; Total flow = 31 cc.min<sup>-1</sup>.



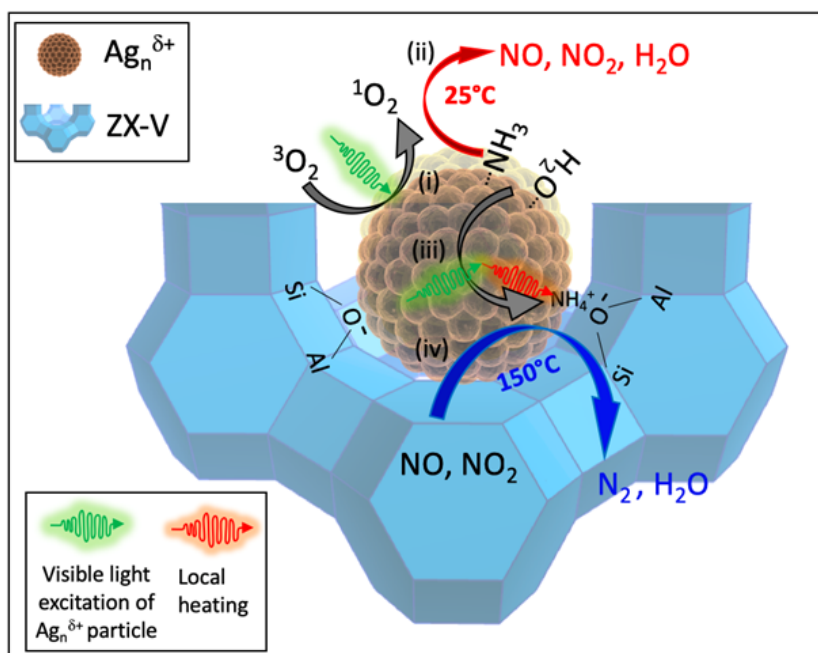
**Figure 8.** IR spectra of Ag@ZX-V sample recorded during the SCR-NH<sub>3</sub> reaction at (A) RT and (B) T = 150°C under visible irradiation (photo-assisted SCR-NH<sub>3</sub>). Reaction conditions: 7 spectres/min; m<sub>cat</sub>=20 mg; Lamp Xe; λ >390nm; irradiance = 110 mW/cm<sup>2</sup>; T=25°C; gas mixture: 150 ppm of NO<sub>x</sub>, 150 ppm of NH<sub>3</sub>, 667 ppm of CO, 5 % CO<sub>2</sub>, 10 % O<sub>2</sub>, 50 ppm of HC and 2 % of water; Total flow= 31 cc.min<sup>-1</sup>.



**Figure 9.** Time-evolution of NO<sub>x</sub> in the gas phase over Ag@ZX-V during photo-assisted SCR-NH<sub>3</sub> reaction in the dark and under visible light at (A) RT and (B) T = 150°C.



**Figure 10.** Time-Evolution of  $\text{NH}_4^+$  ions (indicated by the black line, reporting band area integral intensity at approximately  $1400\text{ cm}^{-1}$ ) and  $\text{NH}_3$  coordinated to Lewis acid sites overlapped with water (indicated by the red line, reporting band area integral intensity at approximately  $1643\text{ cm}^{-1}$ ) at (A) RT and (B)  $150^\circ\text{C}$  during photo-assisted SCR- $\text{NH}_3$  reaction over  $\text{Ag@ZX-V}$  catalyst. Integral values are expressed in  $\text{cm}^{-1}$ .



**Scheme 1.** The proposed photo-SCR reaction mechanisms at RT and  $T = 150^\circ\text{C}$ , over  $\text{Ag@ZX-V}$  catalyst.