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Supplementary Information

Cellulose Nanocrystals Assembled on the Fe_3O_4 Surface as Precursor to Prepare Interfaced C/Fe_3O_4 Composites for the Oxidation of Aqueous Sulfide

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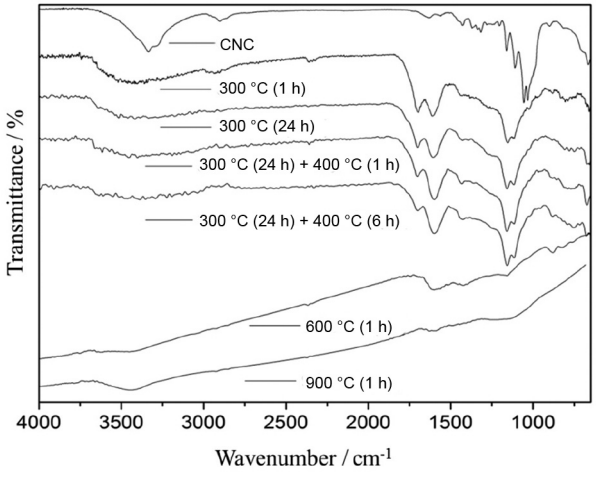

Figure S1. Spectra of the cellulose nanocrystals (CNC) and pyrolyzed samples at different temperatures. Remarks: the sample pyrolyzed at 400 °C was obtained from the sample pyrolyzed at 300 ºC for 24 hours.

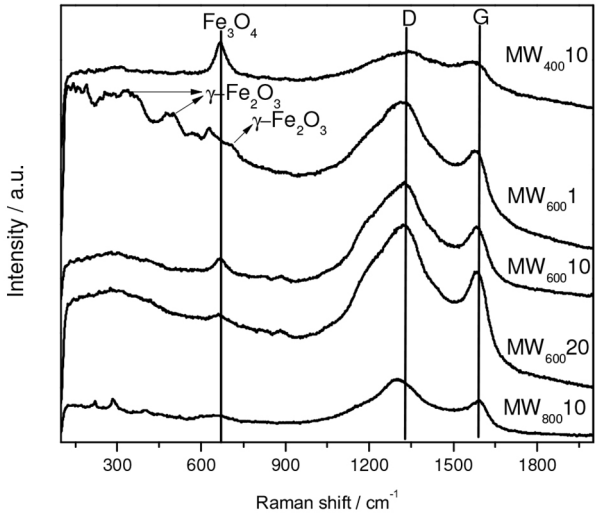

Figure S2. Raman spectra obtained for the composites using the laser 785 nm.

The Figure S2 presents the Raman spectra obtained for the composites. In the figure is able to observe the bands attributed to the magnetite and the carbon in the surface.

The Table S2 presents the hyperfine parameters determined for the Mt and the composites. It can be observed that the Fe_3O_4 constitutes most of the catalysts, which also present different amounts of γ-Fe_2O_3 in their structure.

Table S1. Effect of pyrolysis temperature on the total amount of acidic functional groups

Sample	Acidic functional group / (mmol g^{-1})			Total / (mmol g^{-1})
	pKa < 5	5 < pKa < 8	pKa > 8	
CANCC300 (1 h)	0.056	0.052	0.16	0.27
CANCC400 (6 h)	0.032	0.04	0.049	0.12
CANCC600 (1 h)	–	0.062	0.032	0.094
CANCC900 (1 h)	–	0.065	0.028	0.093

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Table S2. Hyperfine parameters determined for Mt and the composites

Sample	Site	δ[a] / (mm s^{-1}) (0.05)	2ε/ΔQ[b] / (mm s^{-1}) (0.05)	B_{HF}[c] / T (0.05)	AR[d] / % (1)
Mt	(Fe_3O_4)	0.64	0.02	45.8	39
	[Fe_3O_4]	0.29	–0.03	49.4	35
	α-Fe_2O_3	0.36	–0.22	51.7	25
$MW_{600}1$	γ-Fe_2O_3	0.36	0.01	49.2	2
	(Fe_3O_4)	0.66	0.02	45.8	63
	[Fe_3O_4]	0.26	–0.02	49.1	35
$MW_{400}10$	γ-Fe_2O_3	0.33	0.00	49.7	6
	(Fe_3O_4)	0.64	0.02	45.7	60
	[Fe_3O_4]	0.26	–0.02	49.1	34
$MW_{600}10$	γ-Fe_2O_3	0.33	0.09	49.1	4
	(Fe_3O_4)	0.64	0.02	45.9	56
	[Fe_3O_4]	0.27	–0.03	49.1	32
	Fe^{2+}	0.83	0.57	–	8
$MW_{800}10$	γ-Fe_2O_3	0.33	0.00	49.1	3
	(Fe_3O_4)	0.64	0.02	45.1	6
	[Fe_3O_4]	0.27	–0.03	48.9	3
	Fe^{2+}	0.33	0.00	–	9
	Fe^0	0.00	0.00	33.0	79
$MW_{600}20$	γ-Fe_2O_3	0.36	0.01	50.1	22
	(Fe_3O_4)	0.61	0.05	45.3	48
	[Fe_3O_4]	0.27	–0.03	49.1	27
	Fe^{2+}	0.83	0.57	–	3

[a]δ: isomer shift relative to α-Fe; [b]2ε/ΔQ: quadrupole splitting; [c]B_{HF}: magnetic hyperfine field; [d]AR: subspectral relative area.

The thermal decomposition of the composites in air can be observed in Figure S3.

SEM images (Figure S4) showing the morphology of the CNC after pyrolysis at 600 ºC.

The SEM images obtained for the CNC corroborated the formation of thin films and nanofilaments observed in the composites after thermal treatment at 600 ºC.

The UV-Vis band intensities for the different S_n^{2-} species monitored for the composite $MW_{600}1$ can be observed in the Figure S5.

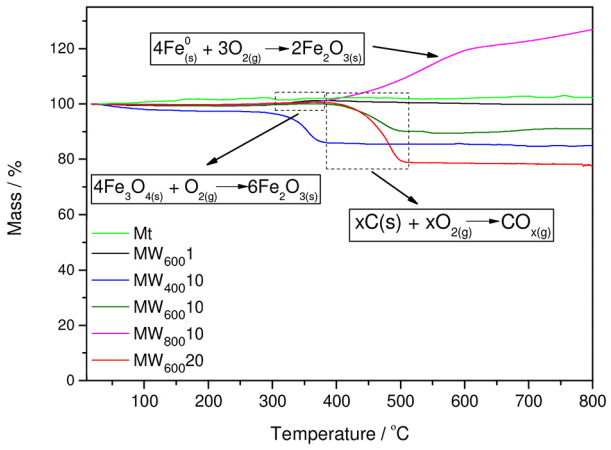

Figure S3. Thermal gravimetric analysis (TG) for composites carbon/Fe_3O_4 and for magnetite in an atmosphere of synthetic air.

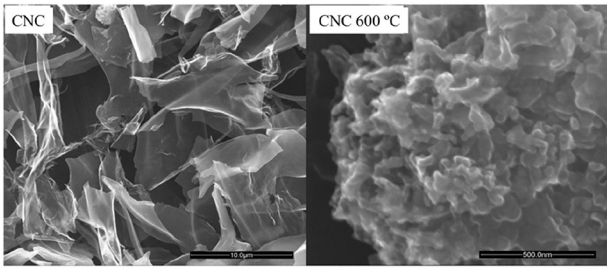

Figure S4. SEM images for the CNC before and after pyrolysis at 600 ºC.

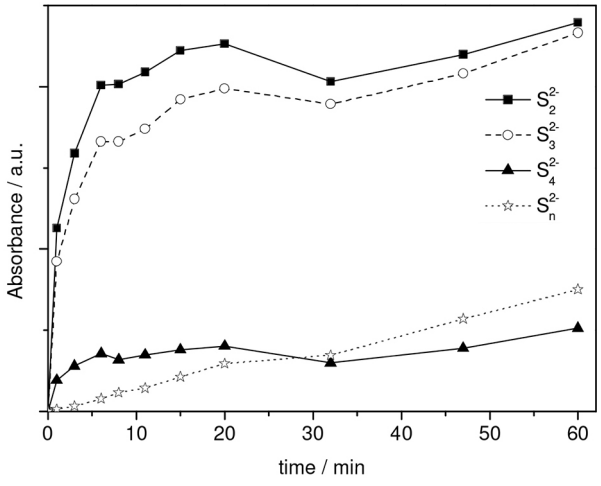

Figure S5. UV-Vis band intensities for the different S_n^{2-} species formed during the reaction of the sodium sulfide with the composite $MW_{600}1$.