

## SUPPLEMENTARY INFORMATION

### **Thermoelectrically polarized amorphous silica promotes sustainable carbon dioxide conversion into valuable chemical products**

Marc Arnau,<sup>a,b</sup> Isabel Teixidó,<sup>a</sup> Jordi Sans,<sup>a,b,\*</sup> Pau Turon,<sup>c,\*</sup>  
and Carlos Alemán<sup>a,b,e,\*</sup>

<sup>a</sup> *IMEM-BRT Group, Departament d'Enginyeria Química, EEBE, Universitat  
Politécnica de Catalunya - BarcelonaTech, C/ Eduard Maristany, 10-14, 08019,  
Barcelona, Spain.*

<sup>b</sup> *Barcelona Research Center in Multiscale Science and Engineering, Universitat  
Politécnica de Catalunya - BarcelonaTech, 08930 Barcelona, Spain.*

<sup>c</sup> *B. Braun Surgical, S.A.U. Carretera de Terrassa 121, 08191 Rubí (Barcelona), Spain*

<sup>d</sup> *Institute for Bioengineering of Catalonia (IBEC), The Barcelona Institute of Science  
and Technology, Baldori Reixac 10-12, 08028 Barcelona, Spain.*

\* [jordi.sans.mila@upc.edu](mailto:jordi.sans.mila@upc.edu), [pau.turon@bbraun.com](mailto:pau.turon@bbraun.com) and  
[carlos.aleman@upc.edu](mailto:carlos.aleman@upc.edu)

**Table S1.** Distribution of the A-D peaks (%) derived from the deconvolution of the Si 2p peak for c-T/aSiO<sub>2</sub> and p-T/aSiO<sub>2</sub> samples.

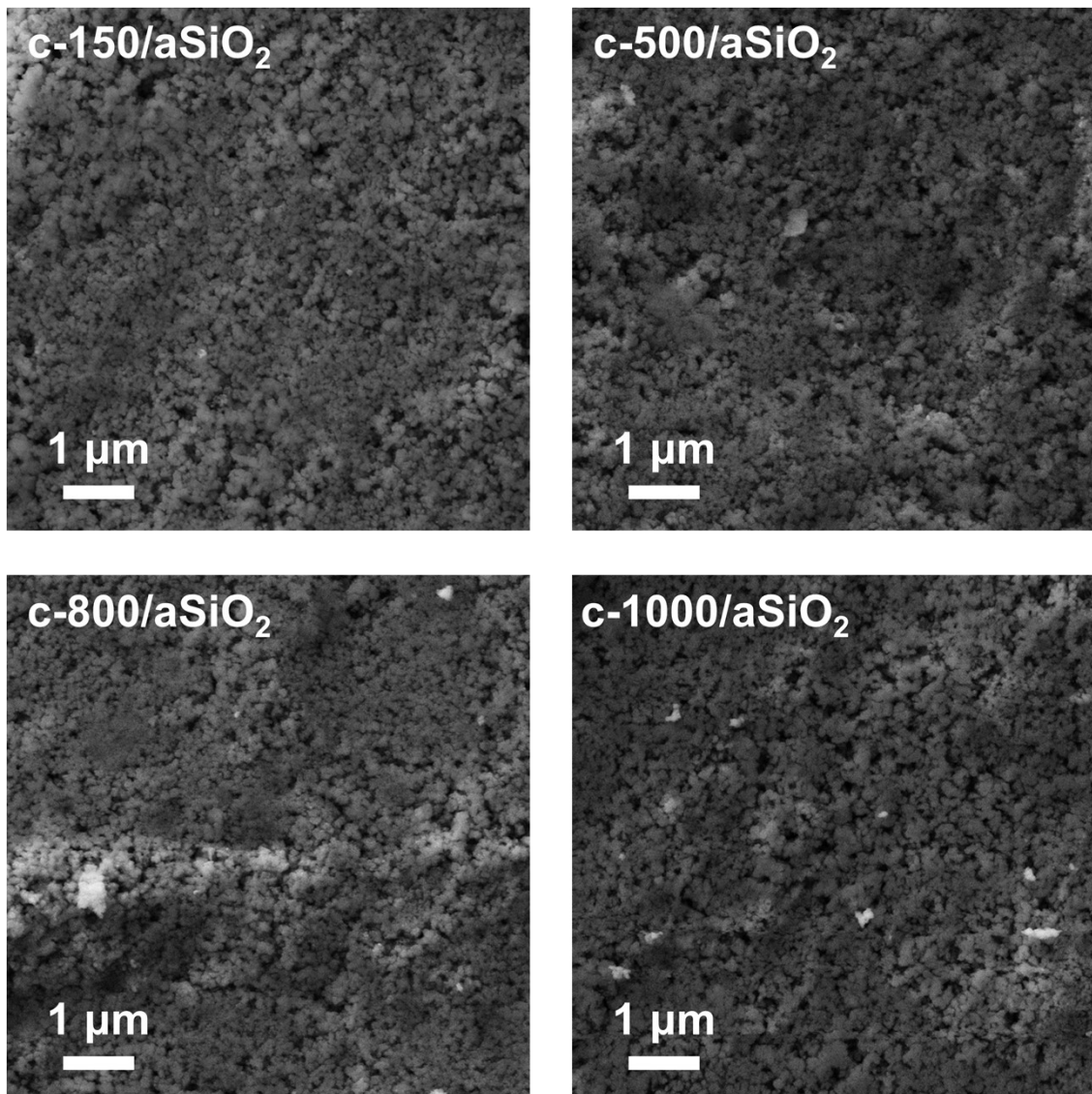
<b>Sample</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
c-150/aSiO <sub>2</sub>	15.5	31.1-	17.8	35.6
c-500/aSiO <sub>2</sub>	31.8	63.7	1.5	3
c-800/aSiO <sub>2</sub>	25.2	50.6	8.1	16.1
c-1000/aSiO <sub>2</sub>	22.2	44.3	11.2	22.3
p-150/aSiO <sub>2</sub>	11.6	23.2	21.7	43.5
p-500/aSiO <sub>2</sub>	10.1	20.3	23.3	46.3
p-800/aSiO <sub>2</sub>	22.5	45.1	10.8	21.6
p-1000/aSiO <sub>2</sub>	26.5	53.0	6.8	13.7

**Table S2.** Yield of products (in  $\mu\text{mol}$  per gram of catalyst;  $\mu\text{mol/g}_c$ ) coming from the  $\text{CO}_2$  fixation reaction. The yield of each product extracted from the catalyst and the supernatant were summed. The reaction was performed using 6 bar  $\text{CO}_2$  and 40 mL of  $\text{H}_2\text{O}$  at 120 °C using c-T/aSiO<sub>2</sub> (control) and p-T/aSiO<sub>2</sub> as catalyst. Blank reactions were performed without catalyst or using untreated aSiO<sub>2</sub>.

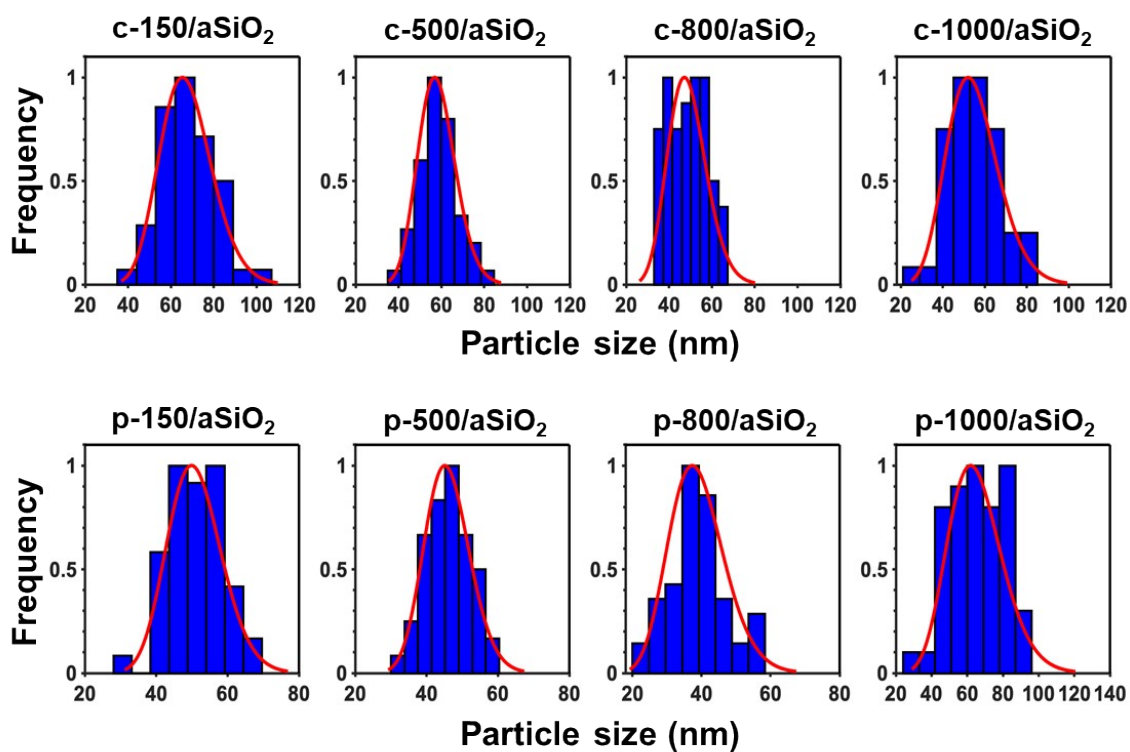
<b>Reaction</b>	<b>Formic acid</b>	<b>Methanol</b>	<b>Acetic acid</b>	<b>Ethanol</b>	<b>Isopropanol</b>	<b>Acetone</b>	<b>Dioxane</b>
Blank (without catalyst)	-	-	-	-	-	-	-
Blank (with aSiO <sub>2</sub> )	-	-	2.3 ± 0.2	-	-	0.4 ± 0.2	-
c-150/aSiO <sub>2</sub> as catalyst	83.7 ± 23.9	-	120.7 ± 21.5	24.4 ± 13.3	100.3 ± 18.7	10.9 ± 2.5	49.8 ± 14.0
c-500/ aSiO <sub>2</sub> as catalyst	-	-	29.3 ± 17.4	44.1 ± 15.6	19.2 ± 8.3	4.7 ± 1.3	6.3 ± 0.2
c-800/ aSiO <sub>2</sub> as catalyst	-	-	29.3 ± 7.5	25.6 ± 8.9	-	-	-
c-1000/ aSiO <sub>2</sub> as catalyst	-	-	29.8 ± 2.8	-	-	-	18.9 ± 1.8
p-150/aSiO <sub>2</sub> as catalyst	313.5 ± 16.9	-	349.1 ± 21.8	-	-	-	123.7 ± 11.7
p-500/aSiO <sub>2</sub> as catalyst	57.0 ± 15.9	-	28.7 ± 10.8	215.2 ± 20.8	258.0 ± 28.4	11.1 ± 2.6	14.9 ± 2.4
p-800/aSiO <sub>2</sub> as catalyst	-	23.5 ± 1.2	19.8 ± 9.4	-	-	22.3 ± 10.3	29.7 ± 8.3
p-1000/aSiO <sub>2</sub> as catalyst	-	-	40.2 ± 13.5	0.2 ± 0.1	-	-	-

**Table S3.** Yield of products (in  $\mu\text{mol}$  per gram of catalyst;  $\mu\text{mol/g}_c$ ) coming from the  $\text{CO}_2$  fixation reaction. The yield of each product extracted from the catalyst and the supernatant were summed. The reaction was performed using 6 bar  $\text{CO}_2$  and 40 mL of  $\text{H}_2\text{O}$  at 120 °C using p-150/aSiO<sub>2</sub> control) and p-HAp as catalyst. Blank reactions were performed without catalyst or using untreated aSiO<sub>2</sub>.

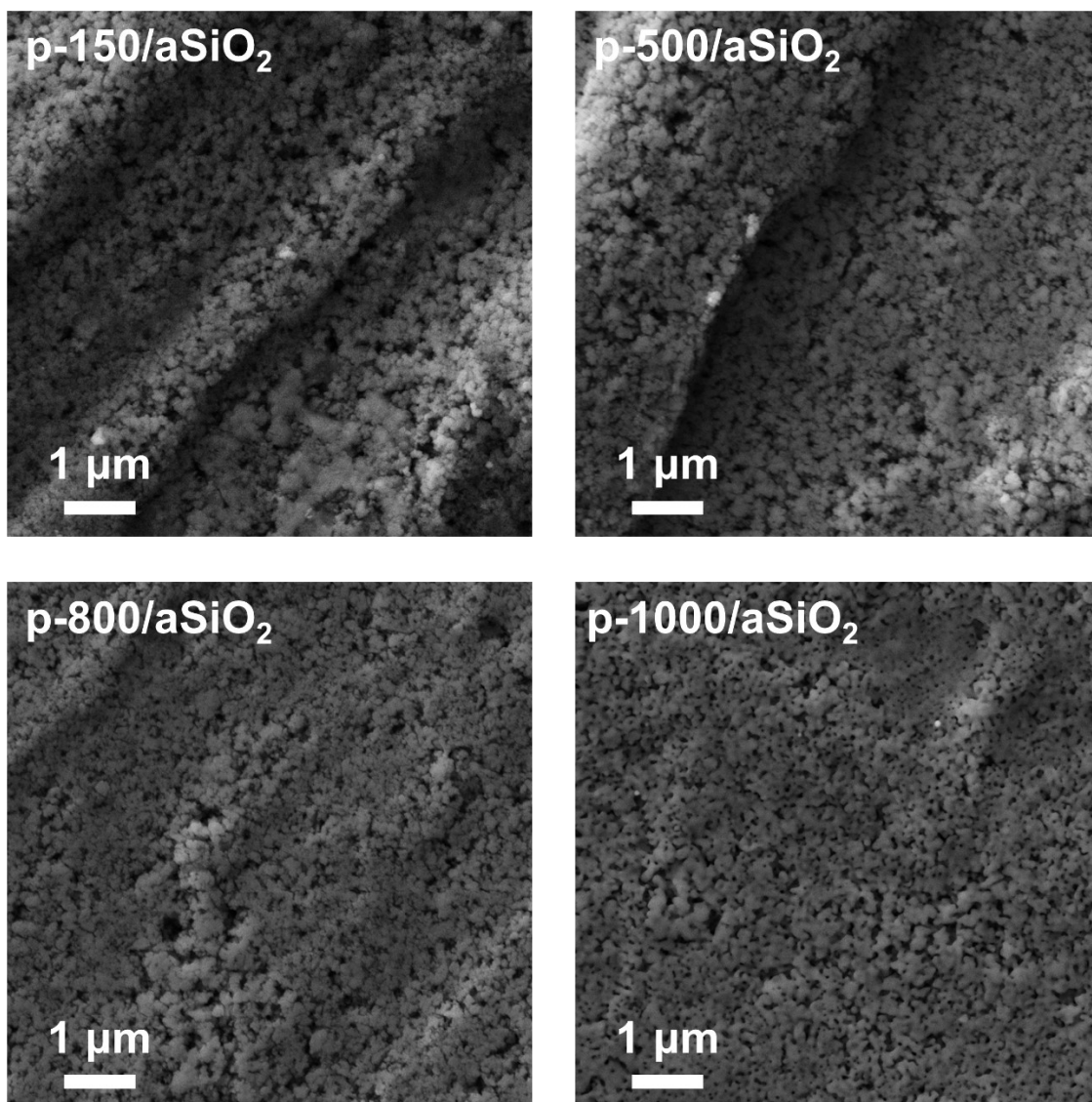
<b>Reaction</b>	<b>Formic acid</b>	<b>Methanol</b>	<b>Acetic acid</b>	<b>Ethanol</b>	<b>Isopropanol</b>	<b>Acetone</b>	<b>Dioxane</b>
Blank (without catalyst)	-	-	-	-	-	-	-
Blank (with aSiO <sub>2</sub> )	-	-	2.3 ± 0.2	-	-	0.4 ± 0.2	-
Blank (with HAp)	-	-	0.2 ± 0.05	0.5 ± 0.1	-	0.2 ± 0.05-	-
p-150/aSiO <sub>2</sub> as catalyst	313.5 ± 16.9	-	349.1 ± 21.8	-	-	-	123.7 ± 11.7
p-HAp as catalyst	101.9 ± 14.3	-	122.2 ± 12.8	51.8 ± 9.2	-	7.5 ± 3.6	-



**Figure S1.** Additional SEM micrographs of c-T/aSiO<sub>2</sub>.



**Figure S2.** Size histograms of c-T/aSiO<sub>2</sub> and p-T/aSiO<sub>2</sub> nanoparticles derived from SEM measurements.



**Figure S3.** Additional SEM micrographs of p-T/aSiO<sub>2</sub>.

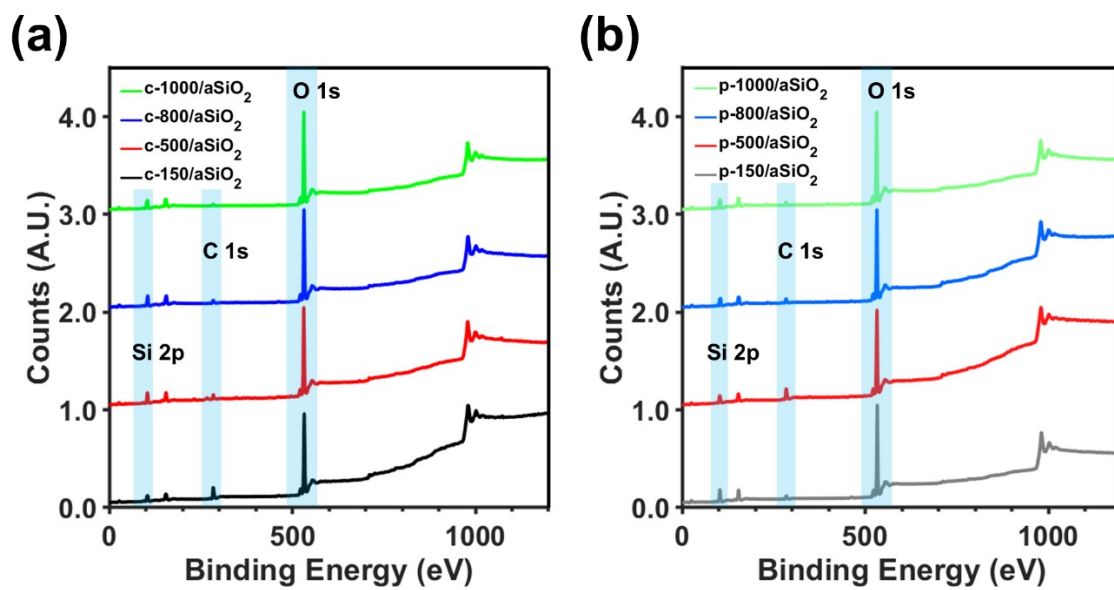


Figure S4. XPS survey scans of (a) c-T/aSiO<sub>2</sub> and (b) p-T/aSiO<sub>2</sub> samples.



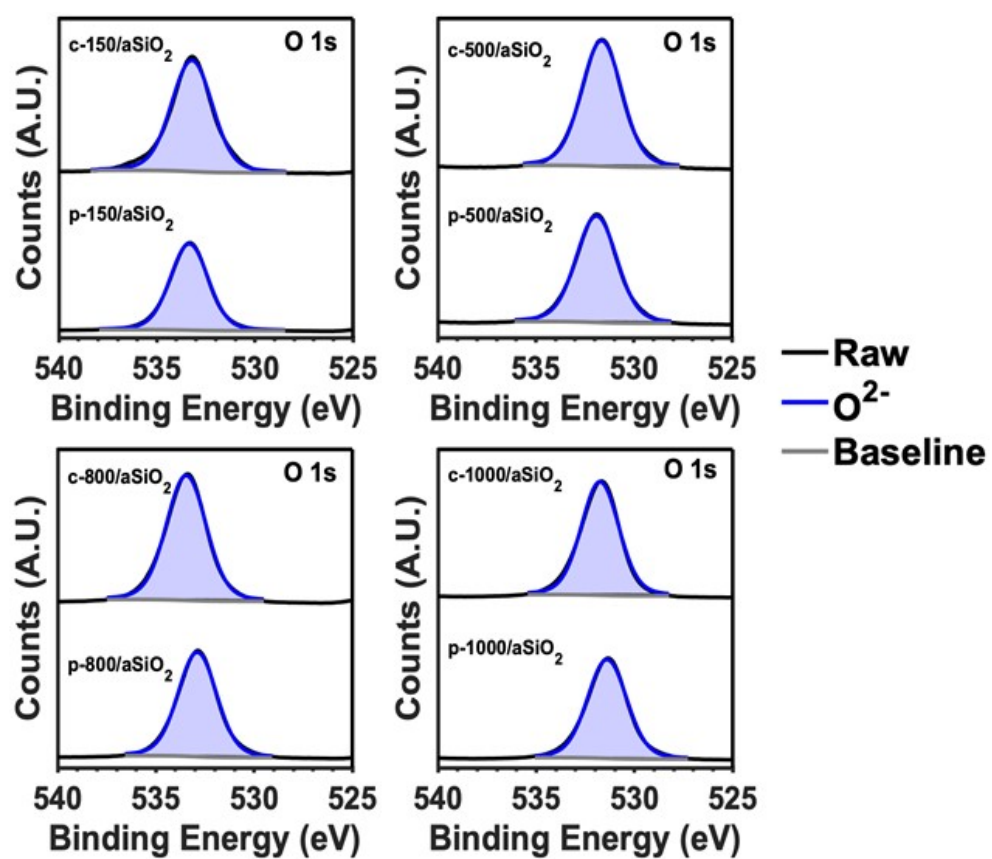


Figure S5. High resolution O 1s spectra of c-T/aSiO<sub>2</sub> and p-T/aSiO<sub>2</sub>.