

Heterogeneous & Homogeneous & Bio-

# CHEM **CAT** CHEM

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CATALYSIS

## Supporting Information

### **Function of the Support and Metal Loading on Catalytic Carbon Dioxide Reduction Using Ruthenium Nanoparticles Supported on Carbon Nanofibers**

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## SUPPORTING INFORMATION

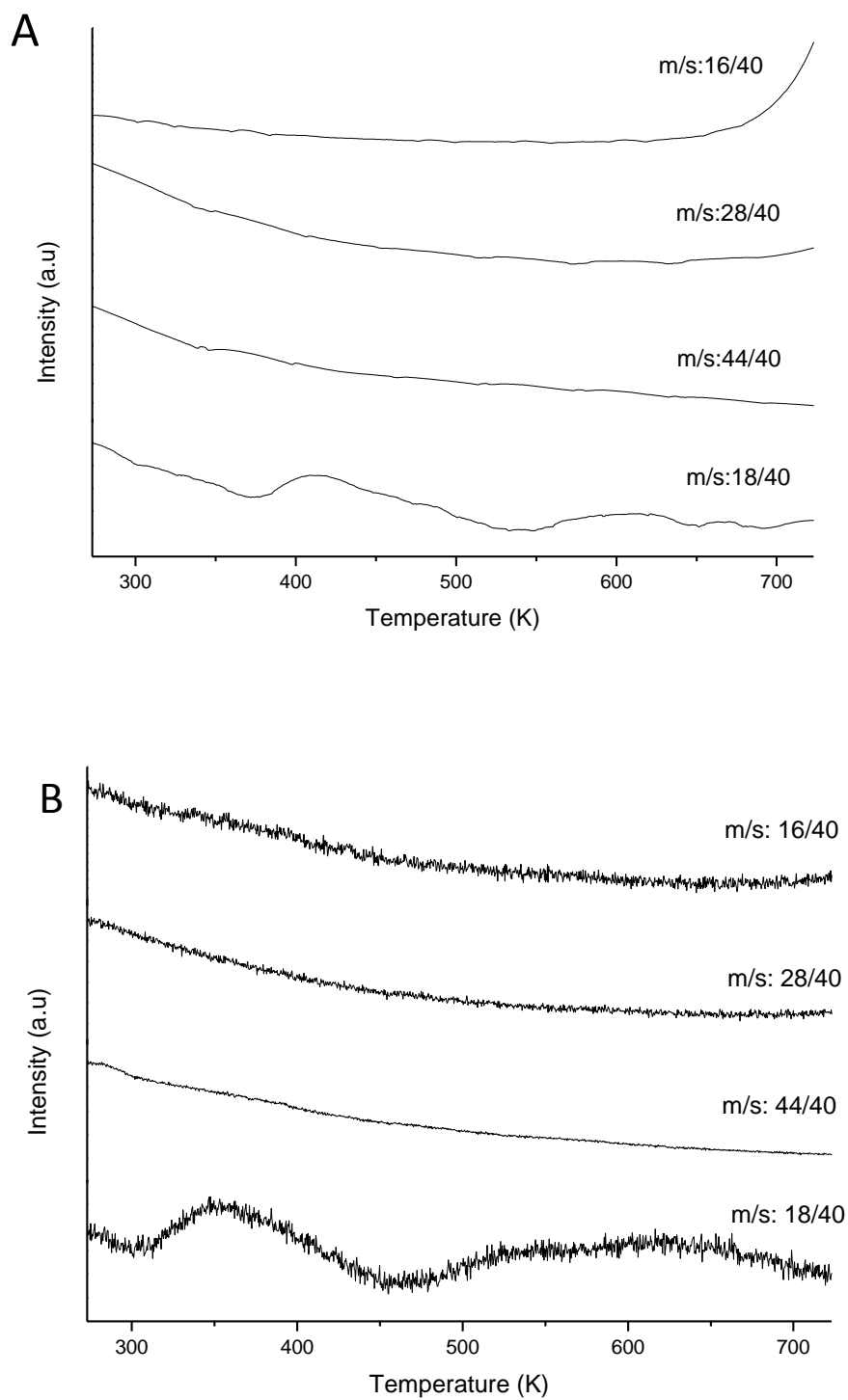
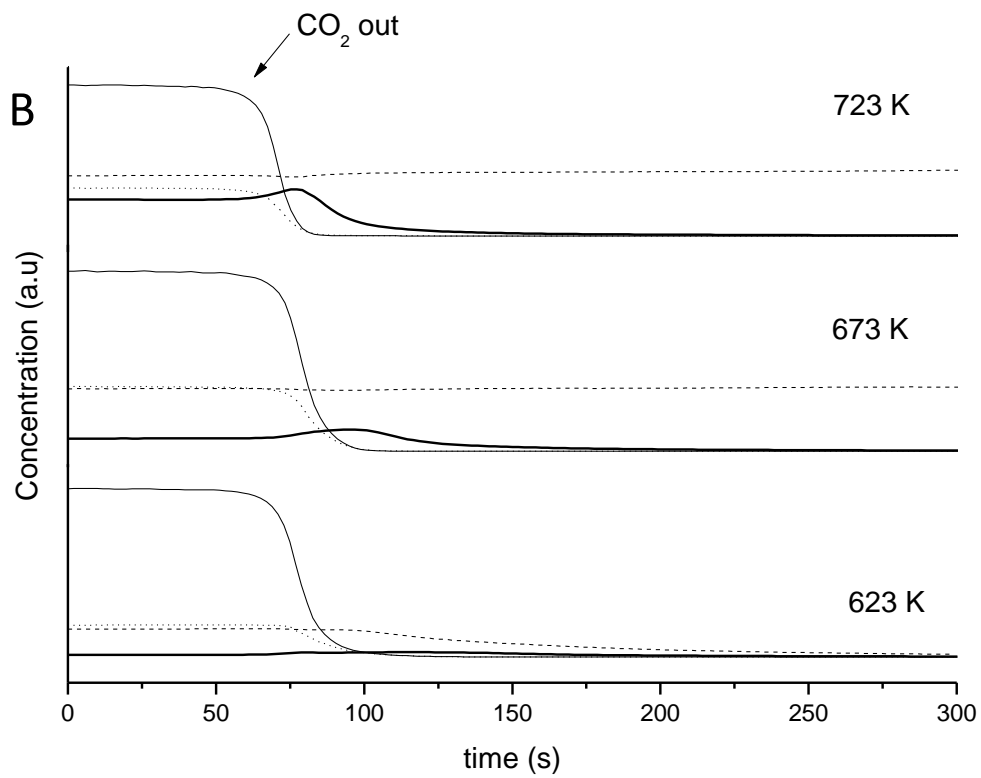
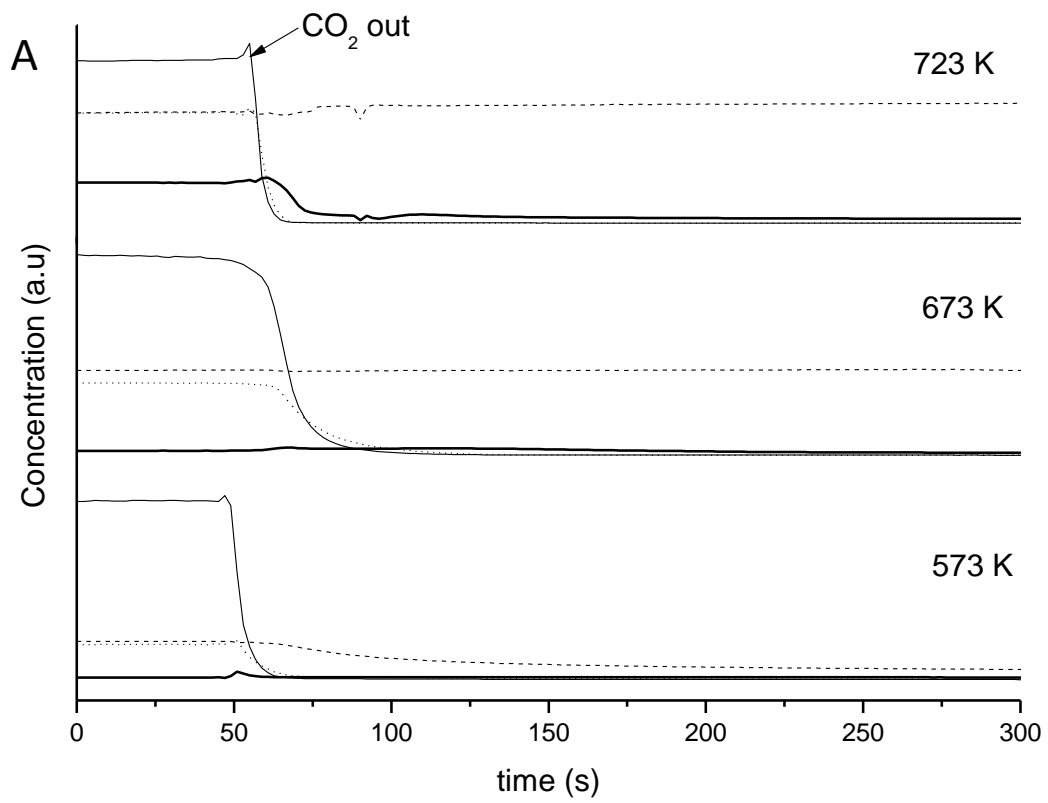


Figure S1. Temperature Programmed Surface Reaction (TPSR) of the supports without Ru: (A) CNF, (B) N-CNF.



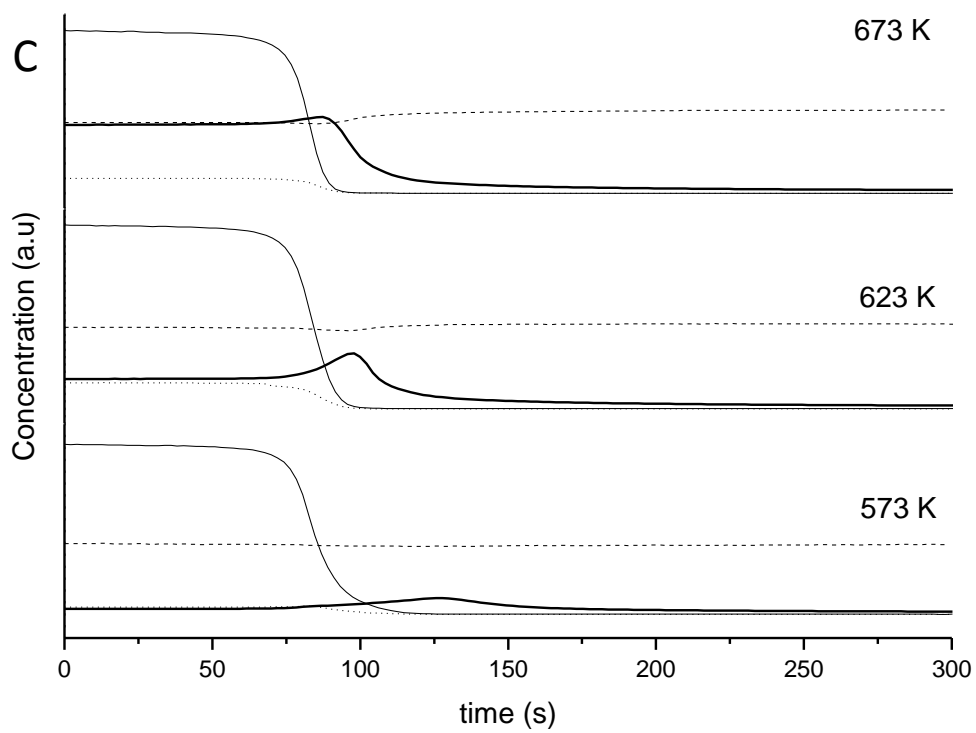
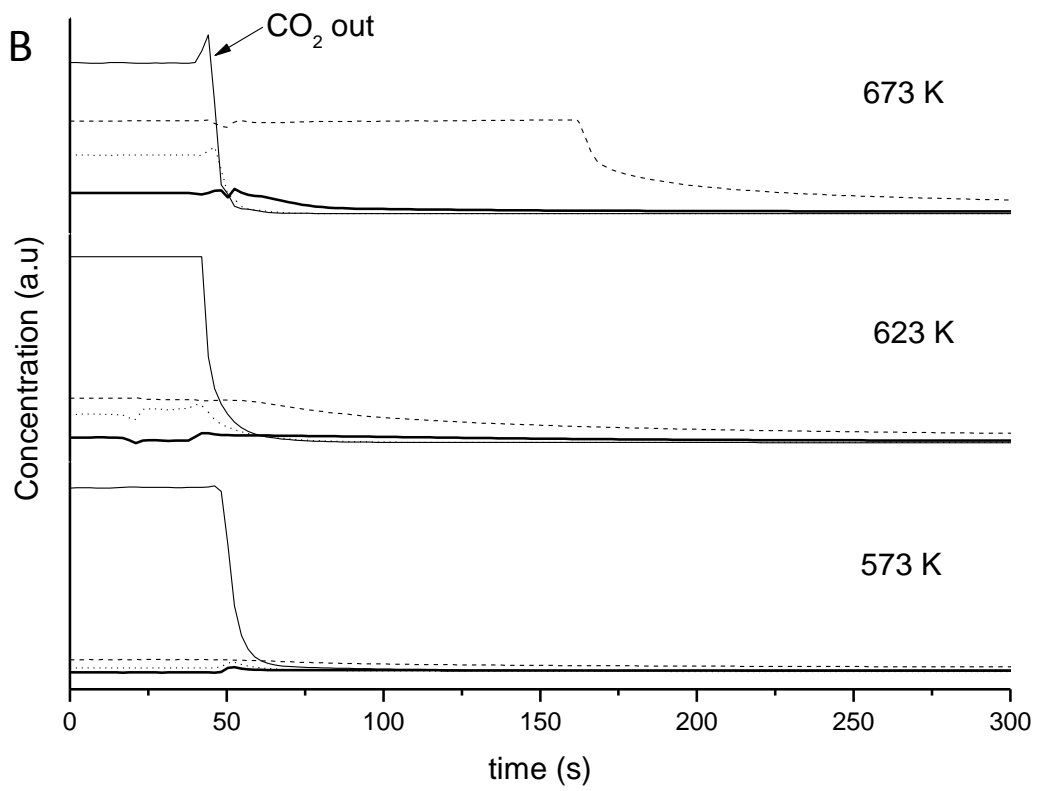
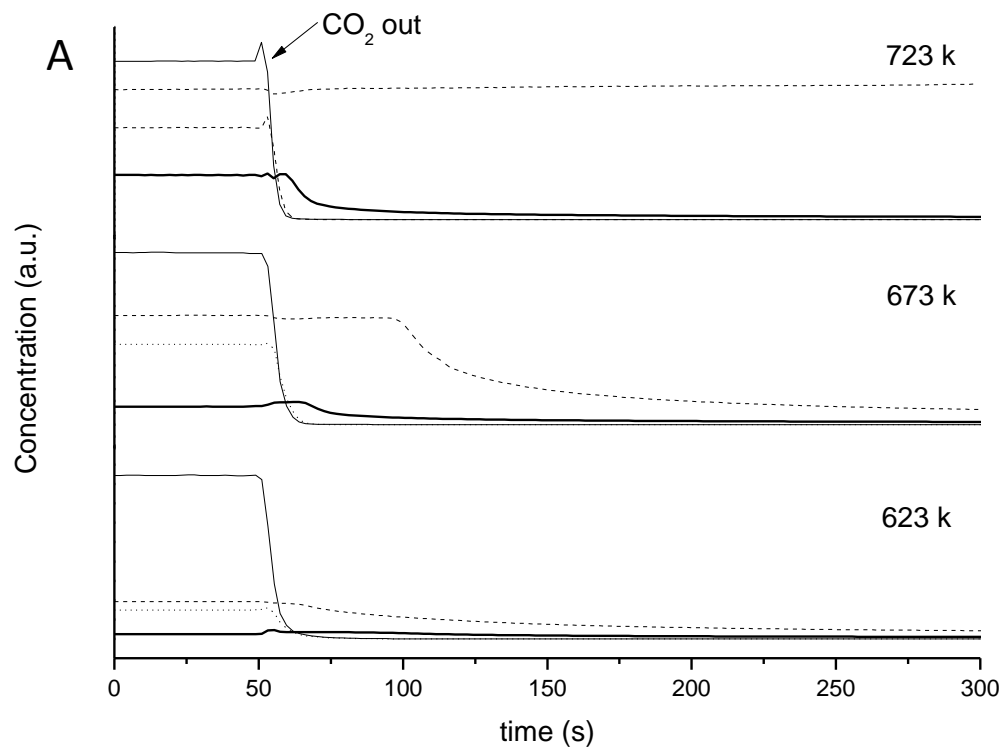


Figure S2. Experiments of transient response to CO<sub>2</sub> removal from gas feed for different Ru loadings on CNF support: (A) 0.5 Ru/CNF, (B) 2% Ru/CNF, (C) 5% Ru/CNF



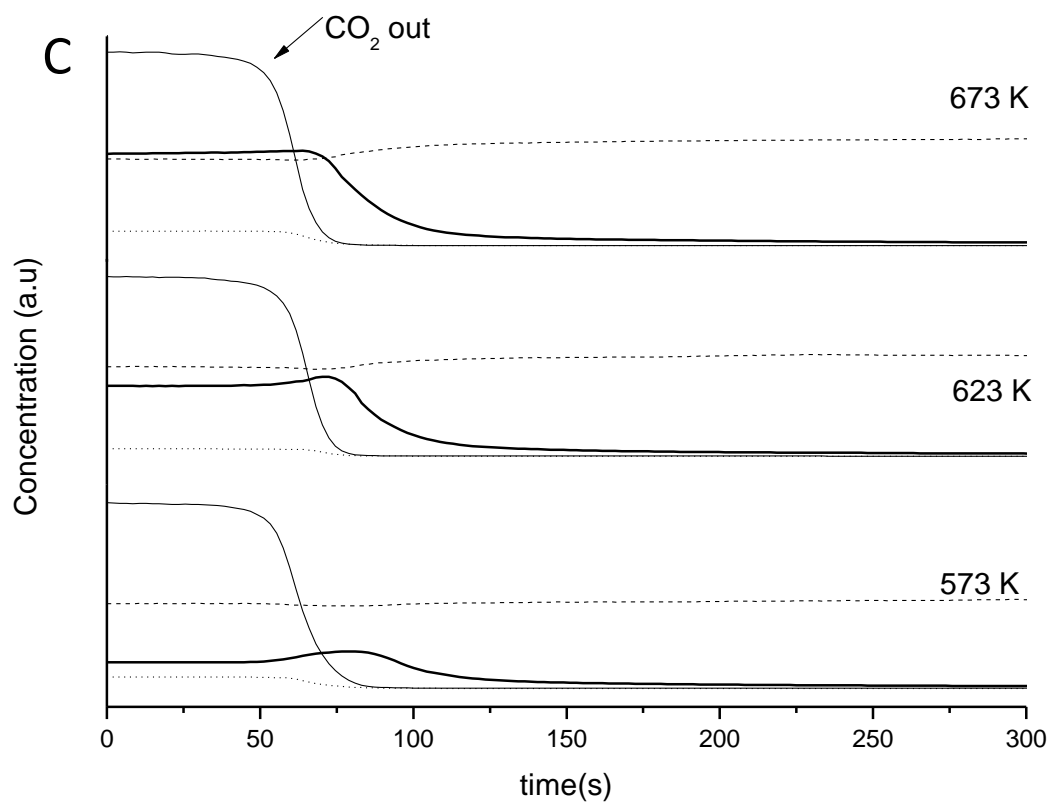


Figure S3. Experiments of transient response to CO<sub>2</sub> removal from gas feed for different Ru loadings on N-CNF support: (A) 0.5 Ru/N-CNF, (B) 2% Ru/N-CNF, (C) 5% Ru/N-CNF.

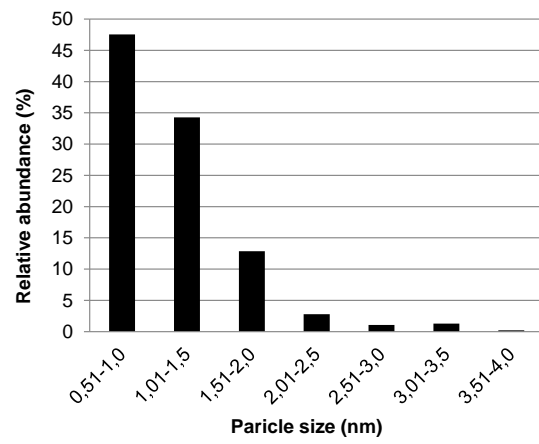
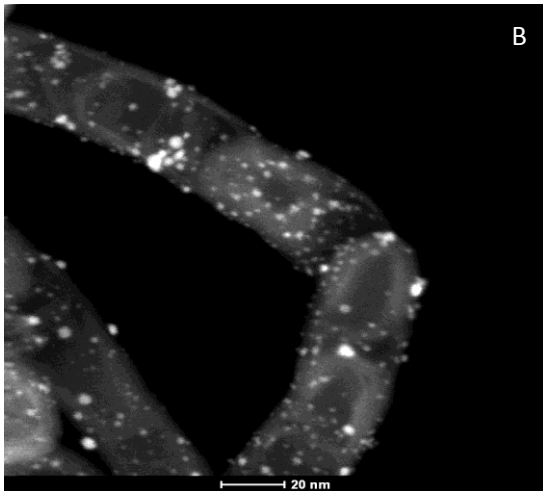
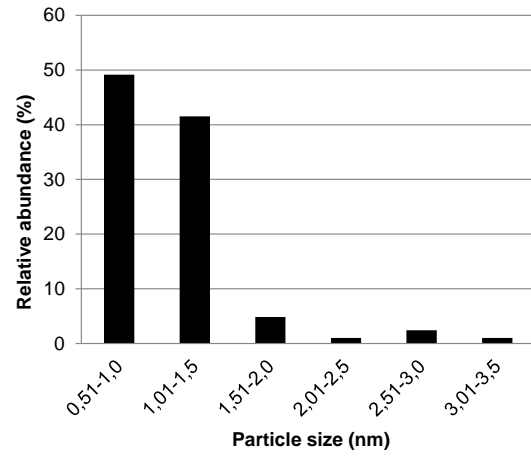
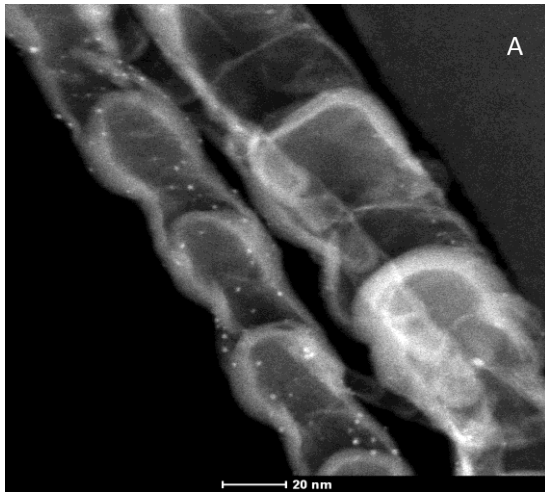


Figure S4. Representative STEM images and particle size distribution of catalysts 0.5 wt%/N-CNF (A) and 5 wt%/N-CNF (B) after long-term testing at 623 K during 20 hours.

Table S1. Parameters used to estimate the concentration of Ru on the perimeter

catalyst	Mean Ru diameter nm	Dispersion <sup>1</sup> %	Moles of Ru on the perimeter <sup>2</sup> x 10 <sup>-5</sup> mol g <sup>-1</sup>
0.5%Ru/CNF	1.24	80	1.3
2%Ru/CNF	1.73	58	2.7
5%Ru/CNF	1.60	62	7.9
0.5%Ru/N-CNF	1.10	91	1.7
2%Ru/N-CNF	1.46	68	3.8
5%Ru/N-CNF	1.74	57	6.7

<sup>1</sup>Dispersion was calculated as  $D=(\text{mean diameter})^{-1} \times 100$

<sup>2</sup> It was estimated using a radius of Ru atom of 130 pm and supposing hemispherical particles