Electronic supplementary information

ACTIVITY AND EVOLUTION OF Pd–Fe-CONTAINING NANOCOMPOSITES IN THE CARBON MONOXIDE OXIDATION

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Catalytic tests

The catalytic tests were carried out at the Topchiev Institute of Petrochemical Synthesis of the Russian Academy of Sciences in the laboratory of Prof. V. F. Tretyakov.

The tests were carried out in a quartz reactor with a diameter of 6 mm where the catalyst was loaded with a volume of ~3 cm^3. The following gas mixture was used: CO 2%, O_2 4%, He 94%. The readings were taken, first, during a heating cycle (at 323 K before the catalyst ignition, then, at 298–303 K to the maximum temperature) and, second, during a cooling cycle (in the temperature range of 303–313 K until the disappearance of the CO_2 peak). The time between injections was 8–10 min (injections after the CO_2 peak was out). The peak emergence times were as follow: CO + O_2 1–3 min, CO_2 5–7 min. The quantitative processing of the chromatograms was carried out using an absolute calibration method.

The catalytic activity of a sample with mass M by 1 gram of the pure metal was calculated using the formula:

$$A\ [\text{L/h}] = U \cdot N \cdot \alpha \cdot M_r / m \cdot M \cdot 2240\ \text{mL/mol}$$

where U is the CO gas stream, mL/h; N is the CO content in the gas mixture, %; α is the CO conversion, %; m is the catalyst mass, g; M is the percentage of metal in the catalyst, %; M_r is the metal molar mass, g/mol. The conversion α was calculated as follows:

$$\alpha = [(C_{IN}–C_{OUT})/C_{IN}] \cdot 100\%$$

where C_{IN} is the initial gas concentration in the mixture, %; C_{OUT} is the final gas concentration in the mixture, %.

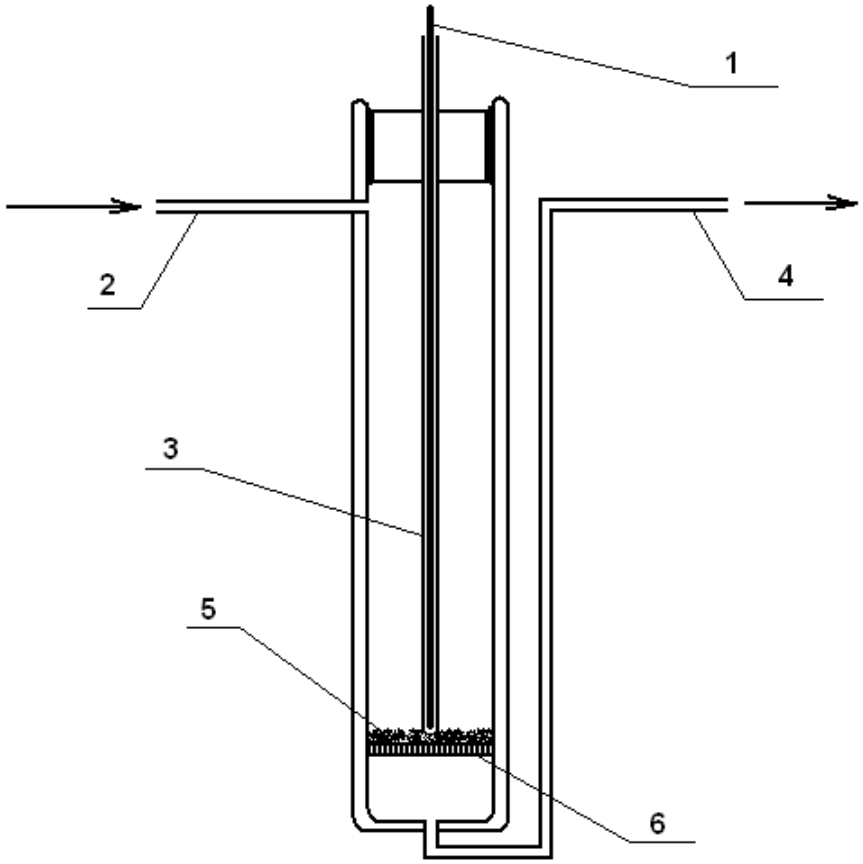

Figure S1. Scheme of a quartz reactor (d = 6 mm) of a laboratory flow-through facility for the CO oxidation: thermocouple (1), inlet of the initial gas mixture (2), tube for the thermocouple with the sealed end (3), outlet of the gas mixture that has passed through the catalyst (4), catalyst (5), and grid for the catalyst (6).

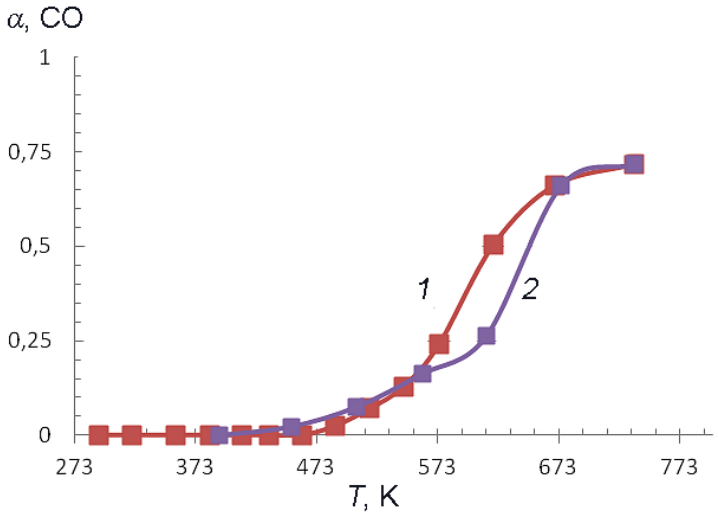

Figure S2. CO conversion over the Fe/SiO_2 catalyst depending on the temperature; the Fe concentration was 0.13 wt %; heating (*1*) and cooling (*2*).

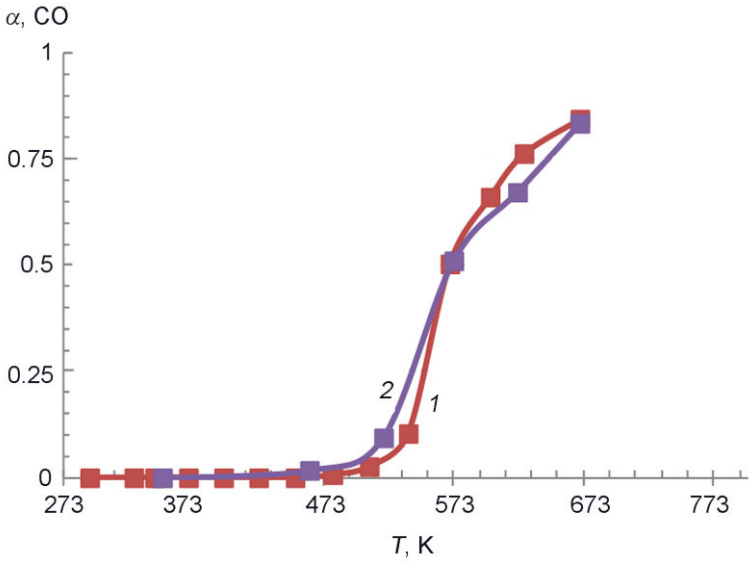

Figure S3. CO conversion over the Pd/SiO_2 catalyst depending on the temperature; the Pd concentration was 0.20 wt %; heating (*1*) and cooling (*2*).

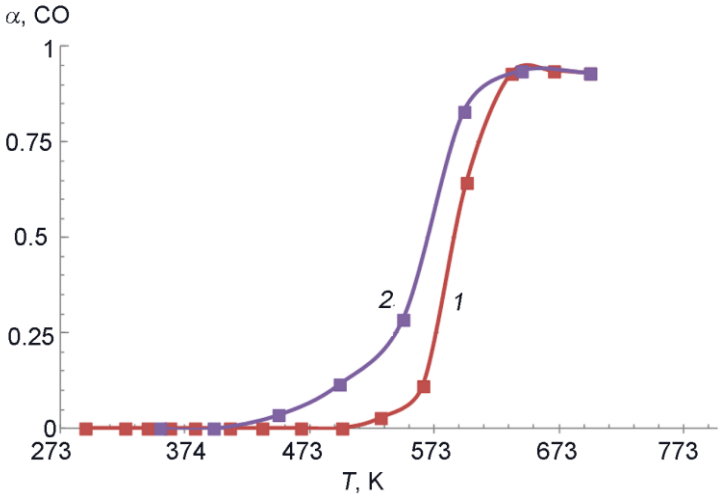

Figure S4. CO conversion over the $Pd–Fe/SiO_2$ catalyst depending on the temperature; the Fe and Pd concentrations were 0.14 and 0.18 wt %, respectively; heating (*1*) and cooling (*2*).