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Influence of noble metals on thermoacoustic oscillations and boundaries of the region of negative temperature coefficient during combustion of *n*-pentane–air mixtures

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Experimental details

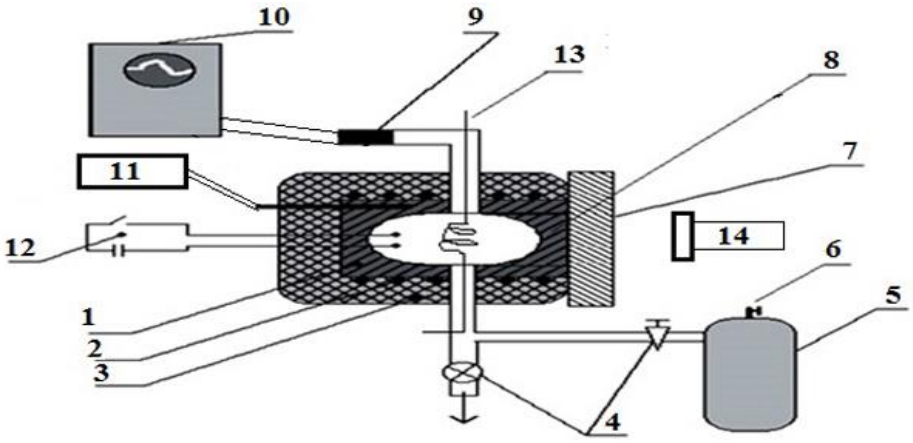

Figure S1 Schematic diagram of the experimental setup: (1) reactor, (2) electric heater, (3) thermal insulation, (4) valves, (5) mixer, (6) pressure reducer safety valve, (7) removable cover, (8) hemispherical insert, (9) pressure transducer, (10) ADC–computer based data acquisition system, (11) digital measuring device for thermocouple, (12) spark ignition circuit, (13) noble metal wire and (14) digital video camera.

The ignition of *n*-pentane–air mixtures was studied in a rapid mixture injection static reactor (Figure S1). The pre-mixed fuel–air mixture from the storage vessel through the solenoid valve entered the reactor, preliminary evacuated and heated to a predetermined temperature. The stainless steel reactor with an inner diameter of 12 cm and a length of 25 cm consisted of two hemispherical parts and a narrow cylindrical one between them. The design of the heater ensured a uniform temperature distribution in the reactor volume,[S1] which was controlled with a movable thermocouple placed on the reactor surface. In a number of experiments, a Pt or Pd wire (0.3 mm in diameter and 40 cm long) was placed perpendicular to the reactor axis in its central part. The experiments were carried out with stoichiometric *n*-pentane–air mixtures in the pressure range of 2–3 atm. The pressure–time history was recorded with a Karat-CI piezoelectric transducer (4 kHz),

the signal from which was fed to a computer through an ADC. Before each experiment, the reactor was evacuated with a 2NVR 5D vacuum pump to a pressure of 10^{-2} Torr. The pressure in the reactor was measured with a vacuum meter and a standard vacuum gauge. The solenoid valve was used to open and close the gas lines. We used *n*-pentane (Merck, chemically pure), Pt (99.9%) and Pd (98.5%). Experiments have always been carried out starting at low temperatures. When the desired temperature was reached, the gas mixture was fed into the reactor for 3 min. The reactor surface was mechanically cleaned when it became necessary to remove the noble metal from the inner surface of the reactor. Ignition delays were measured from the moment the gas supply was stopped until the maximum pressure was reached.

References

S1 N. M. Rubtsov, A. A. Borisov, G. I. Skachkov and K. Ya. Troshin, *Int. J. Chem. Process Eng. Res.*, 2014, **1**, 51.