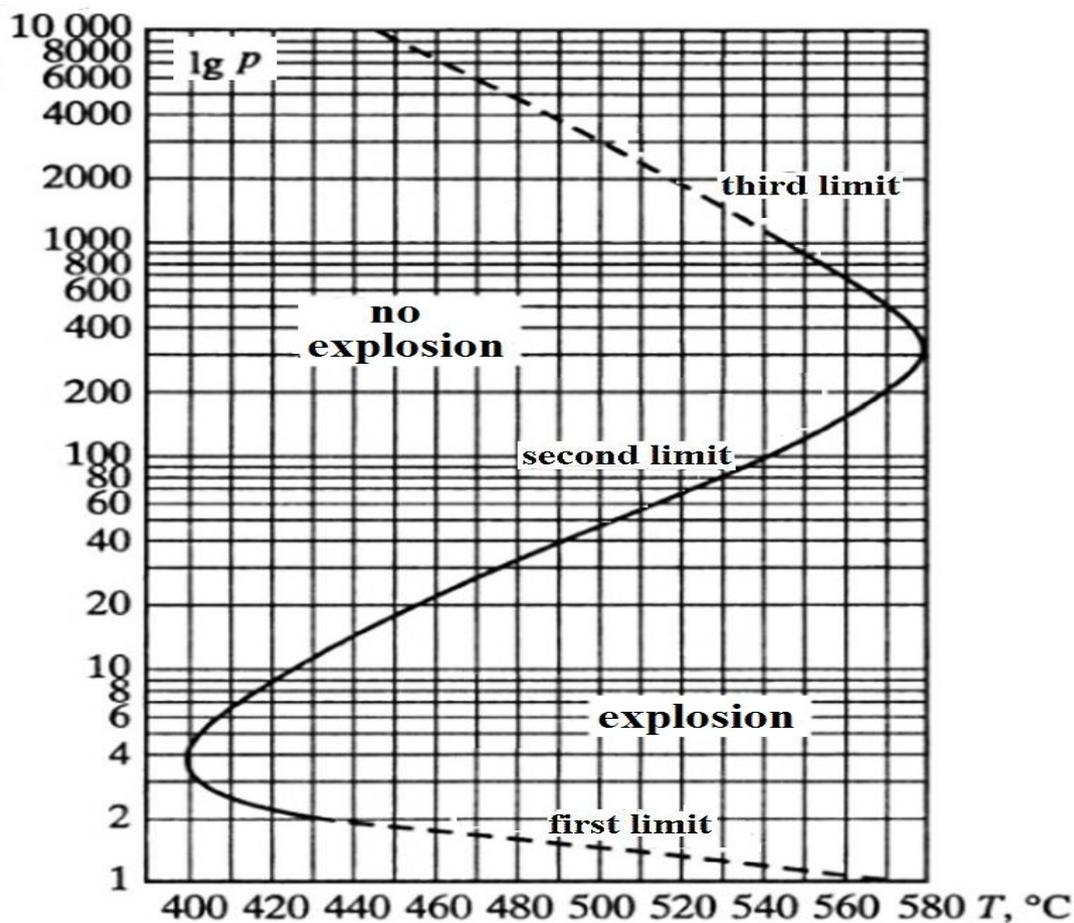


**Thermal ignition of a stoichiometric mixture of hydrogen and oxygen over nanoporous Ni, Co and Fe surfaces near the second ignition limit**

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The experiments were performed with stoichiometric  $2\text{H}_2+\text{O}_2$  gas mixtures. A heated with an electric furnace quartz reactor with a diameter of 4 cm and a length of 30 cm was used; the reactor temperature was controlled by a thermocouple. The reactor was equipped with an optical quartz window at the end. The accuracy of the temperature measurements was  $\pm 0.3$  K. Ignition and flame propagation were recorded using a Casio Exilim F1 Pro color high-speed camera (frame rate 600–1200  $\text{s}^{-1}$ ), sensitive in the spectral range of 420–740 nm. The surface of the reactor was covered with thin layers of nanoporous metallic nickel, cobalt and iron. The precursors were nickel formate, cobalt and iron oxalates. Aqueous suspensions of nickel formate and iron oxalate were obtained, cobalt oxalate was dissolved in alcohol until a saturated solution was obtained, and then the resulting suspensions of nickel and iron salts or cobalt oxalate solution were poured into the reactor. Water or alcohol was removed during pumping and rapid rotation of the reactor.

The reactor was then placed in an electric furnace, heated at a rate of 5  $\text{deg min}^{-1}$  to 600  $^\circ\text{C}$  and held at this temperature for 20 min. The obtained coatings were studied by electron microscopy combined with XRD, namely using a Zeiss Ultra Plus ultra-high resolution field emission scanning electron microscope (SEM) (Germany) equipped with an INCA 350 Oxford Instruments X-ray microanalysis console. Micrographs of the obtained metal coatings, which show that they are porous nanostructures, are presented below. Video recording was started at any time before the mixture was injected into the reactor. The video file was stored in the memory of the Casio Exilim F1 Pro digital camera and then transferred to a computer for subsequent analysis. The pumped and heated reactor was filled with a gas mixture from a high-pressure buffer volume to the required pressure. The limit of the thermal ignition pressure was considered as the mean pressure  $P$  (Torr); at  $P - 0.02P$  ignition occurs, at  $P + 0.02P$  it does not occur, all other things being equal. This value was determined from the results of four independent series of experiments. The pumping time between tests was 30 min. The limit of thermal ignition was measured by reducing the total pressure in the reactor until ignition occurred. Prior to each experiment, the reactor was pumped down to  $10^{-2}$  Torr. The total pressure in the reactor was controlled by an RDG-1 vacuum gauge, and the pressure in the buffer volume was controlled by an exemplar pressure gauge. Chemically pure gases, nickel formate, cobalt and iron oxalates were used.



**Figure S1** The area of auto-ignition (thermal ignition) of  $2\text{H}_2 + \text{O}_2$  mixtures.<sup>S1,S2</sup>

## References

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- S2 B. Lewis and G. von Elbe, *Combustion, Flames and Explosions of Gases*, 2<sup>nd</sup> edn., Academic Press, New York, 1961; <https://doi.org/10.1016/C2013-0-12402-6>.