Importance of the oxygen bond strength for catalytic activity in soot oxidation - DTU Orbit
(23/04/2019)

**Importance of the oxygen bond strength for catalytic activity in soot oxidation**

The oxygen bond strength on a catalyst, as measured by the heat of oxygen chemisorption, is observed to be a very important parameter for the activity of the catalyst in soot oxidation. With both intimate contact between soot and catalyst (tight contact) and with the solids stirred loosely together (loose contact) the rate constants for a number of catalytic materials outline a volcano curve when plotted against their heats of oxygen chemisorption. However, the optima of the volcanoes correspond to different heats of chemisorption for the two contact situations. In both cases the activation energies for soot oxidation follow linear Brønsted-Evans-Polanyi relationships with the heat of oxygen chemisorption. Among the tested metal or metal oxide catalysts Co$_3$O$_4$ and CeO$_2$ were nearest to the optimal bond strength in tight contact oxidation, while Cr$_2$O$_3$ was nearest to the optimum in loose contact oxidation. The optimum of the volcano curve in loose contact is estimated to occur between the bond strengths of α-Fe$_2$O$_3$ and α-Cr$_2$O$_3$. Guided by an interpolation principle Fe$_a$Cr$_b$O$_x$ binary oxides were tested, and the activity of these oxides was observed to pass through an optimum for an FeCr$_2$O$_x$ binary oxide catalyst, which exhibited a rate constant at 550 °C that was 2.3 times higher than the one for pure α-Cr$_2$O$_3$ and 29 times higher than the one for pure α-Fe$_2$O$_3$.

**General information**

Publication status: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre
Contributors: Christensen, J. M., Grunwaldt, J., Jensen, A. D.
Pages: 235-244
Publication date: 2016
Peer-reviewed: Yes

**Publication information**

Journal: Applied Catalysis B: Environmental
Volume: 188
ISSN (Print): 0926-3373
Ratings:
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.86 SJR 2.693 SNIP 2.185
Web of Science (2016): Impact factor 9.446
Web of Science (2016): Indexed yes
Original language: English
Keywords: Brønsted-Evans-Polanyi relationship, Heat of chemisorption, Oxygen bond strength, Soot oxidation, Volcano curve

Electronic versions:
Importance_of_the_oxygen_bond_strength_for_catalytic_activity_in_soot_oxidation.pdf. Embargo ended: 01/02/2018
DOIs:
10.1016/j.apcatb.2016.01.068
Source: FindIt
Source-ID: 2291728605
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review