

EPFL Valais/Wallis SEMINAR

19. 11. 2020, 10:00-11:00, EPFL Valais/Wallis ZOOM Seminar

Using NAP-XPS to identify the optimum surface state of cobalt catalysts for CO preferential oxidation in H₂-rich feedstock

Liping ZHONG

ICPEES, UMR7515-CNRS-Université de Strasbourg,
25 rue Becquerel, 67200 STRASBOURG, France

Catalytic performance is known to be influenced by several factors, with the catalysts' surface oxidation state being the most prominent of all. Cobalt appears as one of the most promising materials for preferential oxidation of carbon monoxide in hydrogen rich mixtures (CoPrO_x)¹. However, the oxidation state of the active sites on cobalt-based catalysts for CoPrO_x is a subject of intense debate². In this work we use operando NAP-XPS combined with DFT and other in situ and ex situ characterization methods to correlate CoPrO_x activity and cobalt oxidation state³. An important effort is devoted to evaluating the effect of the pressure gap between NAP-XPS measurements (0.5mbar) and realistic reaction conditions (1bar). Based on NAP-XPS we identified CoO as the optimum cobalt oxidation state, while first principal calculations provided a rational explanation of this finding. We also noted that CoO is metastable and oxidizes fast under CoPrO_x conditions leading to catalyst deactivation. Based on the critical information provided by NAP-XPS, a novel composite cobalt-based catalyst for CoPrO_x has been designed. Further activity tests and NAP-XPS study showed that by stabilizing the CoO phase the CoPrO_x catalytic activity and stability is enhanced as compared to conventional cobalt catalysts.

References:

- [1] Woods, M. P.; Gawade, P.; Tan, B.; Ozkan, U. S.. Appl. Catal. B Environ. 2010, 97 (1–2), 28–35.
- [2] Zhong, L.; Chen, D.; Zafeiratos, S. Catal. Sci. Technol. 2019, 9 (15), 3851–3867.
- [3] Zhong, L.; Kropp, T.; Baaziz, W.; Ersen, O.; Teschner, D.; Schlögl, R.; Mavrikakis, M.; Zafeiratos, S. ACS Catal. 2019, 9 (9), 8325–8336.

CV: Liping ZHONG



Liping was born in 1992 in Yunnan, China. She received her B.S. in Environmental Engineering from the University of Jinan in 2014. She did her master's training in Environmental Engineering in Kunming University of Science and Technology from 2014 to 2017. Then she went to France for Ph.D. training under supervision of Dr. Zafeiratos, her Ph.D. project is "Atomic-level understanding of cobalt-based catalysts for CO preferential oxidation in H₂-rich feedstock", she will defend her Ph.D. work in December 2020.