Session of Focus Materialchemie – Wednesday, **25.01.2022** 16:00 – @ Seminarraum Lehar 02 (TU-Wien, Getreidemarkt 9, BC, OG. 02, room A46) – join us on ZOOM (ID: 983 0066 2349)

Methanol Steam Reforming Using Perovskite Catalysts

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Methanol **S**team **R**eforming (MSR) provides a promising solution for the storage and on-demand production of hydrogen for the utilization as an energy carrier in e.g.: **P**roton **E**xchange **M**embrane **F**uel **C**ells (PEMFC). Due to high reaction temperatures required and possible side reactions, leading to the formation of carbon monoxide, the use of suitable catalysts is of crucial importance. Even a proportion of 10 ppm carbon monoxide in the inlet gas leads to an 80% loss of PEMFC performance [1]. A promising material for the reduction of the reaction temperature as well as high selectivity towards MSR are perovskite type oxides. These materials, with a general formula of ABO_3, display high resistance against agglomeration of exsolved nanoparticles [2]. The composition of the catalyst can be specifically modified with suitable doping materials for the A- or B-site and can thus produce exsolved nanoparticles on its surface which fit the requirements necessary for MSR. [3]

Different perovskite type oxide catalysts were studied concerning their suitability for catalysing MSR. As a result of the water saturated gas atmosphere a quantification of the reaction gases proved to be challenging. Therefore, a calibration strategy for a **M**ass **S**pectrometer (MS) was applied to be able to compare the different investigated catalysts. Additionally, in-situ XRD was performed to monitor possible changes of the material during reaction conditions.

The experiments showed that each investigated material exhibited catalytic activity towards MSR regarding the yields of H_2 and CO_2 as well as a decrease in the reaction temperature. An increase in the catalytic activity could be tied to doping the B-site with Co and Cu. Interestingly, the formation of CO at elevated temperatures could be observed in all catalysts examined, the degree depending on the basic structure and the doping material used. However, with some catalyst such as $Pr_{0.6}Ca_{0.4}Fe_{0.95}Cu_{0.05}O_3$ and $Nd_{0.6}Ca_{0.4}Fe_{0.9}Cu_{0.1}O_3$, a high selectivity at lower temperatures towards the formation of H_2 and CO_2 instead of CO could be observed, making them particularly interesting for further research in the on-demand production of hydrogen.

References

[1] T. A. Rocha, F. Ibanhi, F. Colmati, J. J. Linares, V. A. Paganin, and E. R. Gonzalez, J. Appl. Electrochem., vol. 43, no. 8, pp. 817–827, Aug. 2013.

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[3] L. Lindenthal, R. Rameshan, H. Summerer, T. Ruh, J. Popovic, A. Nenning, S. Löffler, A. Opitz, P. Blaha and C. Rameshan, Catalysts, vol. 10, no. 3, Art. no. 3, Mar.2020.