

ASPECTS OF PROPANE OXIDATION AT PEROVSKITE CATALYSTS IN A MULTIMODE MICROWAVE OVEN

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To date, only few literature sources report on heterogeneous gas phase catalysis in the multimode microwave field.

The most prominent reasons for this fact are unresolved problems such as precise temperature measurements or pulse-pause-power control. In our previous work, we were able to show that we obtained good power control and precise temperature measurement with a modified gastronomy microwave oven. This oven was equipped with a switching power supply and a pyrometer for temperature measurements¹. The pyrometer was used in order to measure the temperature at the catalyst surface and to control the power input. The determination of the temperature inside the catalyst bed was performed with a thermocouple by recording and evaluating cooling curves after the microwave oven was switched off. In this way, radial and axial temperature profiles could be obtained as well².

Due to their dielectric properties, perovskite catalysts are equally well-suited as microwave absorbers for heating and catalysis. The transformation of microwave energy into heat occurs simultaneously over the whole bulk of the catalyst, whereas microwave-transparent construction materials can be passed by radiation without energy loss. The main advantages of this heating method result from high heating rates that could only be obtained under great difficulties with conventional methods.

A series of technically interesting patents tries to employ the advantages of the microwave technology for three-way-catalysts and diesel soot filters^[3,4,5]. Scientific oriented investigations have only been published scarcely so far⁶.

In our multimode microwave reactor [6], we initially investigated the catalytic propane oxidation for $\text{La}_{1-x}\text{Sr}_x\text{BO}_3$ (with B: Co, Mn) catalysts and found that the dielectric properties of the manganates by far surpassed those of the cobaltates, whereas the catalytic properties of these catalysts behaved completely diametrically. However, both properties can be combined in physical catalyst mixtures and optimized. Optimization can even be improved by using single-phase $\text{La}_{1-x}\text{Sr}_x\text{Co}_{1-y}\text{Mn}_y\text{O}_3$ catalysts. Already for a degree of substitution of 25%, the catalytically superior properties of cobalt can be combined with the exceptional dielectric properties of manganates.

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