Operando characterization differences between packed beds and coatings in heterogeneous catalysis

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The future of emission control will be highly depended on effective and stable catalysts. For the improvement and development of such catalysts, in situ and operando characterization techniques are needed [1,2]. In order to bridge model and industrially relevant systems it is important to compare different catalytic shapes like packed beds and washcoats because these systems exhibit individual challenges in terms of gas flow patterns, temperature homogeneities and the chemical state of the catalyst. Therefore, challenges in regard to the investigation of the gas phase, the chemical state [3] and the temperature distributions of packed powder beds and washcoats, depicted in Fig. 1 were investigated and compared [4]. It was shown that internal and external mass-transfer limitations, which are dependent on the catalyst shape influence spatial gradients and changes of the noble metals chemical state. Furthermore, the different impact of invasive spatially resolved gas probing was investigated. Here the gas phase was, for the packed bed largely unaffected in strong contrast to the gas phase within the washcoated monolith.

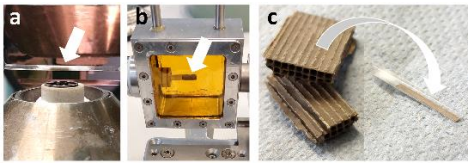

Figure 1: Different catalyst shapes: **a)** packed powder bed, **b)** thickly washcoated chip, **c)** thinly washcoated monolith.

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