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Rationally improving Pt-ceria based exhaust gas catalysts by time and space resolved operando QEXAFS

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Converting pollutants like hydrocarbons or CO at low temperatures is a main challenge in exhaust gas aftertreatment. A promising approach for improving the low temperature activity of exhaust gas catalysts –typically supported noble metal nanoparticles –is to exploit the interaction between the noble metal component and support material like ceria (1).
Recently, we demonstrated the rational tuning of the Pt particle size on ceria: Short reductive pulses allowed to increase the catalytic activity (2). Because of the highly dynamic nature of these catalysts, *in situ* characterization methods with a high time resolution are mandatory to identify and follow structural changes. Complementary quick scanning extended X-ray absorption fine structure spectroscopy (QEXAFS) measurements during reductive treatment at the Ce L3- and Pt L3-edges were used to elucidate the vivid interplay between Pt and CeO2 (3). Furthermore, the activation treatment has been followed in a spatially and time resolved manner using simultaneously *operando* Pt L3 QEXAFS and infrared thermography to identify key parameters for tuning the Pt particles.
The study reveals the dynamic behavior of Pt/CeO2 based catalysts even at low temperatures and pinpoints to the importance of *in situ* characterization for rationally enhancing catalytic systems.

1. M. Cargnello et al., *Science*, 1240148 (2013).
2. A. Gänzler et al., *Angewandte Chemie* **129**, 13258-13262 (2017).
3. A. Gänzler et al., *ACS Catalysis* **8**, 4800-4811 (2018).

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