Possible Bachelor-/Master-“Vertiefer-“ thesis on environmental catalysis in the Grunwaldt group:

**Synthesis, characterization and catalytic testing of noble metal based oxidation catalysts supported on doped rare earth oxides**

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**Start:** Any time possible (at least 2 months before the planned start of the thesis)

**Introduction/Motivation**

Avoiding emissions of toxic pollutants like CO and unburnt hydrocarbons (HC) during the cold start of the engine is a major challenge in automotive exhaust gas catalysis (Fig. 1). It demands an improvement of the low temperature activity of exhaust abatement systems, e.g. of the diesel oxidation catalyst (DOC) [1]. In this regard, exploiting the interaction between reducible supports and the noble metal component represents a promising approach (Fig. 2). Our recent *operando* X-ray absorption spectroscopy (XAS) results demonstrated that in Pt/CeO$_2$ catalysts the size of noble metal nanoparticles [2] and consequently the platinum-ceria interface [3] is strongly dynamic and can be tuned precisely by short reducing pulses enhancing the low temperature CO- and HC-oxidation performance [2]. This catalyst activation and its stability will now be investigated in a consecutive step regarding the support properties (e.g. defect concentration, influence of dopants or morphology).

**Scope**

A thesis on this topic will include the synthesis of the catalysts using hydrothermal synthesis or flame spray pyrolysis, catalytic testing and *in situ* characterization (e.g. DRIFTS or XAS). Depending on the preferences of the student the focus of the work can be shifted towards any of those three aspects.

**References**

