Position Profile for Chinese Applicants running for 2019 Helmholtz – OCPC – Program

PART A (Info about the Position)

Title of the project:

In situ transmission electron microscopy of catalysts for methane dry reforming

Helmholtz Centre and institute:

Forschungszentrum Jülich
Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons

Project leader:

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Description of the project (max. half page)**:**

Dry reforming of methane (DRM) is a convenient way to reduce the emission of two climate poisons (CO_2 and CH_4) and to generate carbon monoxide/hydrogen mixtures, so-called "syngas", which can be further converted to valuable products. Catalysts for DRM include Ni, Cu and Pd nanoparticles on substrates such as Al_2O_3, MgO, CeO_2 and TiO_2. In addition, complex oxides such as perovskites and spinel phases of varying composition, such as $LaNiO_3$ and La_2NiO_4, are promising DRM catalysts. These materials exsolve transition metal particles during reduction, creating a metal/oxide system of defined composition, which acts as active catalyst material. The aim of this project is to analyze a wide range of DRM catalysts under realistic reactive atmosphere conditions in the transmission electron microscope, in order to identify their structural evolution and degradation and to establish structure-activity relationships. In the first part of this project, metal nanoparticle catalysts on oxide substrates will be investigated on the atomic scale using *in situ* electron microscopy. In a second step, *in situ* experiments will be performed on complex perovskites and spinel-based catalysts. It will be especially important to understand the formation of the catalytic active DRM phase by the exsolution of Ni nanoparticles from the substrates under realistic conditions.

Required qualification of the post-doc:

- PhD in materials science, chemistry or a related discipline
- Experience with advanced transmission electron microscopy
- Additional skills in catalysis