

## 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:**

Prof. Dr. Rafal E. Dunin-Borkowski, Dr. Marc Heggen

#### **Email address**

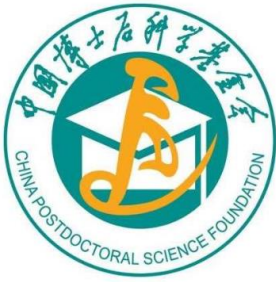
r.dunin-borkowski@fz-juelich.de, m.heggen@fz-juelich.de

#### **Web-address:**

www.er-c.org, <http://www.fz-juelich.de/er-c/EN/>

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

Dry reforming of methane (DRM) is a convenient way to reduce the emission of two climate poisons ( $\text{CO}_2$  and  $\text{CH}_4$ ) 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  $\text{Al}_2\text{O}_3$ , MgO,  $\text{CeO}_2$  and  $\text{TiO}_2$ . In addition, complex oxides such as perovskites and spinel phases of varying composition, such as  $\text{LaNiO}_3$  and  $\text{La}_2\text{NiO}_4$ , 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.



**HELMHOLTZ** RESEARCH FOR  
GRAND CHALLENGES

**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