

2020 Helmholtz – OCPC – Program for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project:

Environmental Barrier Coatings Deposited by Suspension Plasma Spraying and Aerosol Deposition

Helmholtz Centre and institute:

Forschungszentrum Juelich GmbH, Institute of Energy and Climate Research-Materials Synthesis and Processing (IEK-1)

Project leader: Prof. Dr. Robert Vassen

Web-address:

https://www.fz-juelich.de/SharedDocs/Personen/IEK/IEK-1/EN/Vassen_R/Vassen_Robert.html?nn=511174

Description of the project:

SiC based Ceramic Matrix Composites (CMCs) have great potentials as new generation turbine blade structural materials. Gas turbine engines with hot section components made of CMCs are already in service commercially. However, the CMCs face severe volatilization in fast water vapor rich combustion environment, which effects the application of CMCs in gas turbine engines. To prevent such degradation, stable, dense, crack free Environment Barrier Coatings (EBCs) must be applied on the surface of the CMCs. Since currently, the EBCs research field is globally very active. One attractive research topic is to find a suitable process for applying EBCs on CMCs. Atmospheric Plasma Spraying (APS), due to its versatility, has been intensively investigated at IEK-1, Forschungszentrum Juelich GmbH. However, the APS EBCs possesses large amount of amorphous phase, pores and cracks, which are detrimental to the performance of EBCs. Therefore, this project is devoted to develop suitable processes to apply high crystalline, dense and crack free EBCs. Within this project, the post-doc candidate shall focus on depositing EBCs with Suspension Plasma Spraying (SPS) and Aerosol Deposition (AD) or any other possible deposition process at IEK-1. Of course, the fundamental understanding of the deposition process is also required. After deposition, the performance of the obtained EBCs shall also be evaluated.

In this project the main task of the postdoc are:

- Developing a suitable process for depositing EBCs (especially with Suspension Plasma Spraying and Aerosol Deposition)
- Evaluating performance of EBCs such as mechanical properties, porosity, recession rate etc.
- Collaborating with other colleagues at IEK-1
- Operation of SPS and AD facilities with support of technicians at IEK-1

- Writing scientific documents, publications and presenting the results at meetings or conferences

Our offer:

- Exciting working environment on an attractive research campus with excellent infrastructures
- International and interdisciplinary working atmosphere
- Opportunities to use facilities in IEK-1 and discuss with top scientists in the world
- Flexible working hours and various opportunities to reconcile work and private life

Description of existing or sought Chinese collaboration partner institute:

IEK-1 has long lasting successful contacts with different Chinese universities mainly focusing on invitations to conferences and seminars. Especially with Prof. X. Cao, Wuhan University, we have contacts since more than 2 decades as he did his PhD in Jülich.

In principle, we are open to new cooperations with other Chinese universities. We hope to build new partnerships with Chinese research institutes who have interest on coating technologies.

The Chinese collaboration partner institute for this project should have a focus on thermal spraying, arc ion plating, electron beam physical vapor deposition or any related coating technology. The postdoc should help foster the existing collaborations or build up a collaboration with a new partner institute.

Required qualification of the post-doc:

- The candidate needs to be qualified to operate thermal spraying systems. The candidate shall be experienced in thermal spraying techniques, atmosphere plasma spraying, suspension plasma spraying, cold spraying and associate engineering tasks
- The candidate shall have knowledge in material science or mechanical engineering
- The candidate shall have experience in Origin, AnalySIS, Matlab or equivalent software tools
- The candidate shall be familiar with the basic characterization methods such as scanning electron microscope, X-ray diffraction, indentation test etc.
- The candidate shall be communicative and able to work in a team
- Candidates with international experience (e.g. in Europe) are preferred