

Helmholtz Call for Chinese Applicants Interested in Running for CSC 2021 Fellowship

- Helmholtz Centre:** Forschungszentrum Jülich GmbH – www.fz-juelich.de
- Department/Institute:** Institute of Energy and Climate Research, Plasmaphysics (IEK-4)
- Supervising scientist:** Prof. Dr. Andrey Litnovsky
- University for registration or for a future degree:** Ruhr-Universität Bochum
- Research Field:** Material Science
- Position open for:** **PhD Student X** **Sandwich PhD Student** □
- Title of the research:** Studies of advanced SMART alloys with reduced hardness and improved machinability

More description of research topic:

The Self-passivating Metal Alloys with Reduced Thermo-oxidation (SMART) have been developed in recent years initially for fusion power plant application. The modern SMART alloys consist of tungsten and chromium. Yttrium and Zirconium are used as an active element in SMART systems, significantly improving their performance. Unlike pure tungsten, SMART alloys feature the unique resistance to oxidation both in dry and humid atmosphere up to temperatures of 1000°C. The oxidation resistance makes SMART systems very attractive candidates for use in high-temperature energy systems, including solar power receivers and heat exchangers. Significant progress has been achieved in development of SMART alloys in recent years. Bulk smart alloys with the linear dimensions of up to 10 cm were developed by using the combination of mechanical alloying and field-assisted sintering technology (FAST).

At the same time, the present SMART alloys feature high hardness and low ductility, which significantly reduces their machinability and hence, make their practical application rather difficult. Additionally, mechanical alloying used for production is relatively slow and resource-consuming process. Recent studies show that the full alloying may be attained during the FAST process and that the complete mechanical alloying may not be necessary for the production of SMART systems. The present Ph.D. topic is aimed at investigating two important fundamental research topics:

- The influence of grain size, elemental distribution, impurity content and phase formation on hardness and machinability and on oxidation resistance of SMART systems;
- The feasibility of realizing the SMART alloy system with the desired microstructure, hardness and ductility using the partial mechanical alloying combined with FAST.

Specific requirements:

A candidate needs to have a background in solid-state physics, material science or mechanical engineering. Experience in alloy development and thermo-mechanical characterization of metals along with knowledge on mechanical alloying, field-assisted sintering technology (FAST-SPS), electron microscopy and X-ray diffraction spectroscopy are of advantage.

Working Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2021

Language Requirement: Very good knowledge of English language, written and spoken. German language courses are organised in the context of our in-house training program and are free of charge.

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