Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : Masenelli-Varlot Given names : Karine

Status (prof., assistant prof., …) : Professor

Laboratory : MATEIS Website address : http://mateis.insa-lyon.fr/

Institution : INSA Lyon Website address : https://www.insa-lyon.fr/

Scientific competence of the supervisor:

30 years experience in electron microscopy (SEM, TEM), with specific expertise on in situ experiments, environmental microscopies. H-index 39 (Google Scholar). 19 supervised PhD students up to now.

Two major publications in the field proposed for the PhD :

1. Frankberg et al., Highly ductile amorphous oxide at room temperature and high strain rate. Science, 366, 6467 (2019), 864-869
2. L. Joly-Pottuz et al., CeOx elastic properties: an in situ ETEM nanocompression study, JOM (2024), available online. doi: 10.1007/s11837-024-06397-6

Website address of the personal page : https://mateis.insa-lyon.fr/fr/content/karine-masenelli-varlot

Supervisor's email : karine.masenelli-varlot@insa-lyon.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-2 and IV-12

Title : Development of in situ nancompression testing of ceramic nanomaterials in environmental transmission electron microscopy

Subject :

Ceramic nanomaterials, known to be brittle at bulk, can present a clear plastic behavior even at room temperature. This behavior can be studied thanks to in situ mechanical testing in a transmission electron microscope. Recent results show the interest of developing these experiments in an environmental microscope to control the gaseous environment and eventually avoid sample reduction under the electron beam. The development of such in situ nanocompression experiments in an environmental transmission electron microscope (ETEM) is the core of this project. The microscope used is Cs-corrected, which lead to the possibility to perform high resolution imaging. The experiments will be carried out on several types of ceramics, sensitive to the electron beam. The effect of the electron beam is a pending question on this kind of experiments. A comparison of the plastic behavior of a sensitive ceramic depending on the electron dose or without electron beam may give interesting results for the community of in situ nanotesting community. The presence of oxygen prevents the reduction of the ceramic, like ceria for instance. Alumina may be sensitive to the presence of water. Experiments under gas (oxygen, water...) will be developed at high resolution to determine the dislocations or stacking faults responsible of the plastic behavior of ceramic materials. Simulation works being complementary, a collaboration with scientists specialized in simulation works is

Keywords :

in situ testing; transmission electron microscopy; deformation mechanism

Expected collaborations :

collaboration with scientists specialized in simulation works; collaboration with other scientists of MATEIS laboratory (ceramic group) to choose interesting samples to be tested by in situ TEM nanocompression

Background required from the applicant :

Physics. Knowledge in mechanical testing and deformation mechanisms of materials, or characterization of materials by scanning or transmission electron microscope would be appreciated.

Existence of a PDF file detailing the proposal ("yes" or "no") : no

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