

PhD-student position at the Université Paris Nord for 3 years (to begin in Oct.-Dec. 2011)

“Synthesis of novel binary nitrides via high pressure - high temperature techniques and physical vapour deposition.”

Description of the work:

The planned research of the PhD-student will include synthesis of novel advanced nitrides at high pressures to 50 GPa and high temperatures to 3000 K via chemical reactions in high-pressure apparatuses such as the laser heated diamond anvil cell and multi-anvil press. This could include experiments on the mildest P-T conditions of formation of advanced binary nitrides of the group IVB and VB elements (e.g. c-Zr₃N₄, or η-Ta₂N₃), the search for novel nitrides (phases or compounds) of the same elements, their characterisation, and properties measurements. Depending on the funding, the work will be extended by the PVD deposition of c-Zr₃N₄ films with the aim to compare the elastic, mechanical, and optoelectronic properties of the films and of the HP-HT products. The novel HP-HT products and the PVD films should be characterised using a variety of methods such as X-ray- and electron diffraction, electron microscopy and microprobe analysis. The properties (elastic, mechanic, optical, optoelectronic, sound velocities) should be examined at atmospheric pressure and on compression to 100 GPa applying nanoindentation, Raman spectroscopy, laser ultrasonics, and XRD combined with the synchrotron radiation.

Requirements to the candidate:

Master diploma or equivalent in condensed matter physics, chemistry, materials science, mineralogy or similar. Experience in work with high pressure devices, in structural analysis (e.g. Rietveld refinement, interpretation of the electron diffraction patterns), experimental micro-optics and spectroscopy, or application of lasers is of advantage. Since the work includes handling of microscopic objects as well as operation of high-precision optical and mechanical tools, the potential candidate should have a reasonable degree of manual dexterity and tend to accurate and patient work. Good English language skills in writing and speaking are required; the knowledge of French would be of advantage.

Place of work:

The PhD-work will be performed in the walls of a French research laboratory "Laboratoire de Sciences des Procédés et des Matériaux" located on the campus of the University Paris Nord in Villetaneuse (suburb of Paris). The interested candidates should submit (preferably via Email) to

Dr. Andreas ZERR

LSPM-CNRS, Institut Galilée

Université Paris Nord

99, av. J. B. Clément

93430 Villetaneuse

FRANCE

Tel: +33(0)14940-3493/-2075

Fax: +33(0)14940-3938

E-mail: zerr@univ-paris13.fr

Related publications:

- Zerr A., Miehe G., Riedel R., Synthesis of cubic zirconium and hafnium nitride having Th₃P₄-structure.

Nat. Mater. **2**, 185-189 (2003)

- Dzivenko D. A., Zerr A., Bulatov V. K., Miehe G., Li J., Thybusch B., Brötz J., Fueß H., Brey G., Riedel R., High-pressure multianvil synthesis and structure refinement of oxygen-bearing cubic zirconium(IV) nitride.

Adv. Mater. **19**, 1869-1873 (2007)

-Zerr A., Miehe G., Li J., Dzivenko D. A., Bulatov V. K., Höfer H., Bolfan-Casanova N., Fialin M., Brey G., Watanabe T., Yoshimura M., High-pressure synthesis of tantalum nitride having orthorhombic U₂S₃ structure. *Adv. Funct. Mater.* **19**, 2282-2288 (2009)

- Zerr A., Chigarev N., Brenner R., Dzivenko D. A., Gusev V., Elastic moduli of hard c-Zr₃N₄ from laser ultrasonic measurements. *phys. status solidi - Rapid Research Letters* **4**, 353-355 (2010)