Project Proposal for 2011 DocMASE Candidates

Project Title	***Superhard Coatings***
Main University and Advisor	**Linköping University** (Linköping, SWEDEN) Prof. Magnus ODÉN, Assist. Prof. Naureen GHAFOOR
Second Univ. and Advisor	**Universitat Politècnica de Catalunya** (Barcelona, SPAIN) Dr. Emilio JIMÉNEZ-PIQUÉ
Associated Partner(s)	**SECO Tools** (SWEDEN) Dr. Mats JOHANSSON
Project Description	This is a fundamental material science study of design of advanced and multifunctional nanocopomosites based on transition metal nitrides and carbides applicable as super to ultra hard coatings for cutting tools. The scope is to understand transformations on an atomistic level and to improve the required material properties in temperature and pressure space. The selection of elements and the composition in the studied materials systems should be of direct relevance with the existing industry demands, and thus will be carefully chosen considering theoretical and experimental aspects. A grad student is supposed to steer the synthesis, characterization, and application testing of the coated materials. Synthesis will be carried out by using reactive magnetron sputtering and arc deposition platforms in collaboration with SECO tools. Compositional and structural investigations will involve X-ray diffraction, ion beam analysis, and electron microscopy instruments (S-TEM). Phase transformation studies will be complemented with differential scanning calorimetry and in situ characterization, e.g. SAXS/WAXS at synchrotron light sources (ESRF/APS). The morphology and composition of nanocomposites play an important role in deformation mechanisms at subjected high temperature and pressure conditions and thus high temperature deformation perhaps through micropillar deformation using combination of focused ion beam and high temperature nanoindentor will be performed.
References and Previous Publications	A. Knutsson *et al*: Thermally Enhanced Mechanically Properties of Arc Evaporated Ti0.34Al0.66N / TiN Multilayer Coatings, *J. Appl. Phys.* 108 044312 2010. L. Rogström *et al:* Age hardening in arc-evaporated ZrAlN thin films, *Scripta Mater*. 62 [10] 739-741 2010.