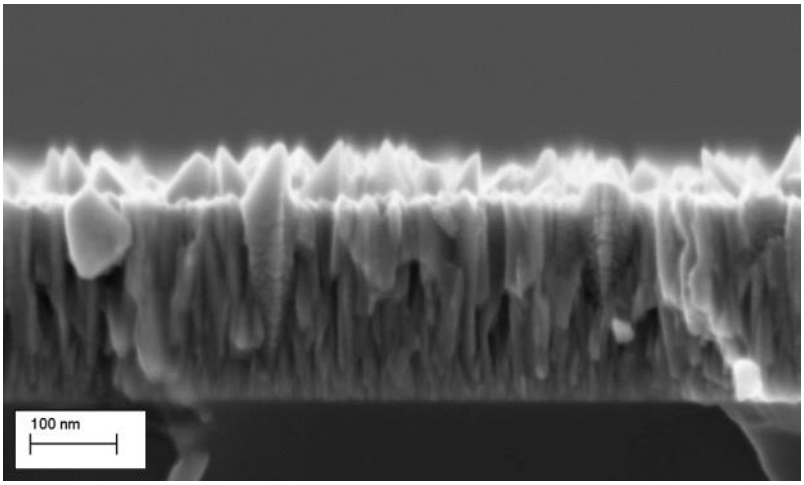
High entropy nitride coatings by HiPIMS deposition

Multi-component and high-entropy nitrides are a growing field with a promise of new functional materials. The interest in the field was sparked by the adjacent field of high-entropy and multi-component alloys, and the promise consists of both demonstrated properties and a possibly very large freedom for materials design.[1]

The purpose of this project is to investigate the effect of morphology on (mechanical) properties of high-entropy nitride (HEN) coatings deposited by magnetron sputtering. Columnar morphology, frequently observed in sputter deposited coatings, results in underdense materials with voided grain boundaries. The grain boundaries both reduce the cohesion of the coating and act as weak spots for corrosion protection. By ionizing a fraction of the sputtered atoms, the energy input into the growing film can be significantly enhanced, and the growth modified controlled.

In this project, growth of HEN by HiPIMS will be investigated. The studied HEN material will be based on early transition metals. The work included deposition of the coatings, including optimization of the deposition process; characterization of the deposited films by SEM and XRD; and basic characterization of mechanical and electrical properties by nanoindentation and 4-point probe measurements, respectively.

What	MSc thesis project, 30 hp
When	Spring semester 2027 (exact dates to be determined)
Where	Solid-state electronics, Department of Electrical Engineering
Supervisor	Tomas Kubart (tomas.kubart@angstrom.uu.se) in collaboration with Erik Lewin, Dept. of chemistry - Ångström



Cross section SEM of a (Ti,V,Zr,Nb,Hf)N coating

[1] Lewin E, *J. Appl. Phys.* 127, 160901 (2020)