

# Industrialization of electron beam additive manufacturing process for tooling applications – A study on the process chain, productivity, quality and performance

*Tuesday, 26 April 2022 14:00 (20 minutes)*

The industry segment of tooling applications has demonstrated significant developments in the field of Additive Manufacturing (AM) in the last decade. Progressing all the way from prototyping to high Technology Readiness Levels (TRL), thus enabling production capabilities. Especially, in relationship to Laser Powder Bed Fusion (L-PBF) and Laser Metal Deposition (LMD) technologies. The latest years though there has been an effort to explore additional AM technologies and enable further the capabilities of AM towards tooling applications. Mainly, with the assistance of Electron Beam Melting (EBM) process that offers processing of high-alloyed material concepts that appear to be challenging otherwise. The latter is due to the high pre-heating temperatures during processing offered by EMB, which allows the material to suffer less due to buildup of residual stresses from the complex thermal history and high cooling rates during the manufacturing.

Uddeholms AB has previously demonstrated on a pilot scale the performance capabilities of the EBM process in respect to the high alloyed and commercially available tool steel powder grade Vanadis® 4 Extra AM. In the present communication, a focused effort on highlighting the production capabilities relevant to industrial needs is presented. Process modifications were implemented in order to address the design complexity required for the relevant tooling applications in focus. In addition, aspects of the entire process chain such as dimensional tolerances, surface quality, post treatment operations including heat-treatment or Hot Isostatic Pressing and machining operations were all addressed and evaluated. Moreover, characterization of the product quality and assessment of its performance towards sliding wear were included in the present study. The investigation highlights the competitive side of the tool steel grade processed by EBM, achieving performance levels that are qualified in the tooling applications while presenting advantageous alternatives to conventional production routes in terms of lead times.

## Speaker Country

Sweden

**Primary author:** OIKONOMOU, Christos (Uddeholms AB)

**Co-authors:** SELTE, AYDIN (Uddeholms AB); Mr HÖGMAN, Berne (Uddeholms AB)

**Presenter:** OIKONOMOU, Christos (Uddeholms AB)

**Session Classification:** Additive Manufacturing

**Track Classification:** Additive manufacturing