Oxidation behavior of a superalloy manufactured using AM with various surface treatments

Background

Additive manufacturing (AM) is becoming an increasingly important manufacturing technique to produce components of nickel superalloys. These components are used at high temperatures in oxidizing or corroding environments.

In order to ensure oxidation and corrosion resistance, material surfaces get treated specifically using a variety of methods such as polishing, shot peening, electrolytic etching, or isotropic superfinishing (ISF). These processes are not only influenced by the manufactured surface (e.g. near-surface porosity) but also the subsequent post-processing steps such as heat treatment. It is essential to understand the material's oxidation and corrosion resistance in order to ensure material integrity during application.

The purpose of this study is to investigate the oxidation behavior at 900°C in air of LPBF manufactured Hastelloy X material in as-built, heat treated, and surface treated state. Therefore, a variety of heat treatments in protective atmosphere and surface treatments such as polishing, shot peening/grit blasting, and isotropic superfinishing (ISF) are going to be applied to the material prior to oxidation testing. The material will be investigated using light optical microscopy (LOM) and scanning electron microscopy (SEM).

The LPBF samples will be manufactured at Chalmers, heat treatment steps material (porosity, surface etc.) will be studied in as-built, heat treated, and surface treated condition at Chalmers. Surface treatments will be performed within CAM2 and ISF will be applied by REM Surface Engineering. Oxidation tests will be performed at the High Temperature Corrosion Center at Chalmers (Chemistry).

Requirements:

We are looking for a master student with a profile towards material science. A solid background in additive manufacturing is an advantage.

Extent and time plan:

- Period (January-June 2021)
- Number of credits 30 ECTS/högskolepoäng (hp).
- The thesis is intended for one student

More information:

Contact main supervisor – Fiona Schulz for more information about the project. Apply with your CV, academic transcripts and a cover letter in English. Welcome to apply!

Supervisors and examiners:

Industrial Supervisors:	Agustin Diaz (adiaz@remchem.com)
Main supervisor at Chalmers:	Fiona Schulz (sfiona@chalmers.se) – CAM^2
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