HÖGSKOLAN VÄST

Laser Metal Deposition using Alloy 718 Powder

Influence of Process Parameters on Material Characteristics

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AKADEMISK AVHANDLING

som med tillstånd av Forsknings- och forskarutbildningsnämnden
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Abstract

Title: **Laser Metal Deposition using Alloy 718 Powder – Influence of Process Parameters on Material Characteristics**

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Additive manufacturing (AM) is a general name used for manufacturing methods which have the capabilities of producing components directly from 3D computer-aided design (CAD) data by adding material layer-by-layer until a final component is achieved. Included here are powder bed technologies, laminated object manufacturing and deposition technologies. The latter technology is used in this study.

Laser Metal Powder Deposition (LMPD) is an AM method which builds components by fusing metallic powder together with a metallic substrate, using a laser as energy source. The powder is supplied to the melt-pool, which is created by the laser, through a powder nozzle which can be lateral or coaxial. Both the powder nozzle and laser are mounted on a guiding system, normally a computer numerical control (CNC) machine or a robot. LMPD has lately gained attention as a manufacturing method which can add features to semi-finished components or as a repair method. LMPD introduce a low heat input compared to conventional arc welding methods and is therefore well suited in, for instance, repair of sensitive parts where too much heating compromises the integrity of the part.

The main part of this study has been focused on correlating the main process parameters to effects found in the material which in this project is the superalloy Alloy 718. It has been found that the most influential process parameters are the laser power, scanning speed, powder feeding rate and powder standoff distance. These process parameters have a significant effect on the temperature history of the material which, among others, affects the grain structure, phase transformation, and cracking susceptibility of the material. To further understand the effects found in the material, temperature measurements has been conducted using a temperature measurement method developed and evaluated in this project. This method utilizes a thin stainless steel sheet to shield the thermocouple from the laser light. This has proved to reduce the influence of the laser energy absorbed by the thermocouples.