Research theme	Additive manufacturing
Research title	Developing a method to optimize process parameters for Selective Laser Melted metal components
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Research period	From September 2013 to May 2014
Company	National Aerospace Laboratory (NLR)
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Background

One of the first challenges in metal Additive Manufacturing (AM), or 3d-printing of metals, is to develop an efficient method for the evaluation and optimization of process parameters. Within metal AM there are many parameters that affect the performance of the final part. In order to bring AM to its potential success there is a need to understand, predict and optimize the process.

Assignment

The objective is to develop a method for finding production parameters for newly processed materials out of a minimal amount of resources. Questions were reviewed like how are product and material quality characterized, and which parameters influence product and material quality? The statistical analysis tool, design of experiments, is used to find optimum process parameter settings.

Results

First steps of the method have been developed using literature, results from experiments and so gained experiences. From the lessons learned along, improvements for the sub steps are suggested. Porosity within a part was found to be the most important performance indicator at this stage. It was seen that part's porosity is highly related to the applied scan strategy, and energy input prescribed by ratio P/v.

Personal experience

It was great to have the opportunity to contribute to the development of a very relevant topic within mechanical engineering. I really liked the fact that the assignment consisted of a combination of theoretical and practical work. That is, trying to understanding the physics of the process but also preparing build files, operating the machine and analyzing/characterizing results. During the work I have gained great insight in all the relevant topics and complexities involved within metal additive manufacturing, which has resulted in a very interesting master assignment.

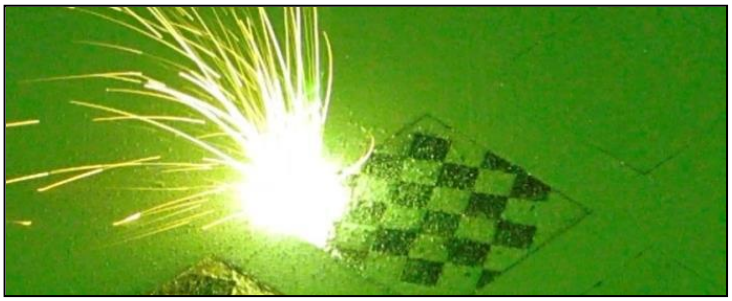

Figure 1 – Spatter as result of laser exposure. Dark areas have already been exposed. The scan pattern of a single layer is visible.

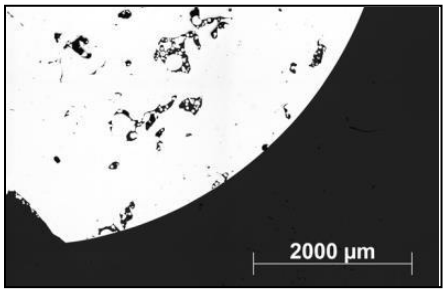

Figure 2 – Porosity within of a part produced with poor parameter settings