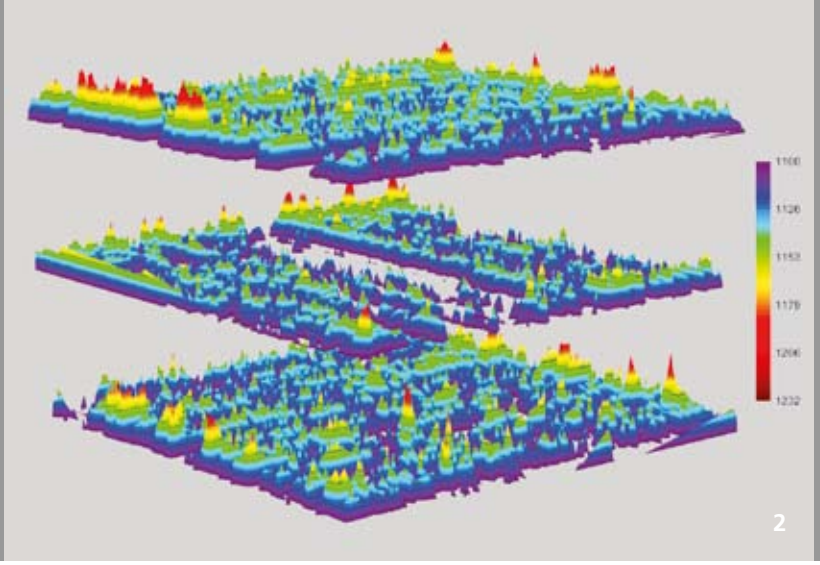

QUALITY CONTROL FOR SLM BY MEANS OF SIGNAL ACQUISITION FROM THE INTERACTION ZONE

Task

Quality control is one of the most important research topics in the additive manufacturing process Selective Laser Melting (SLM) since one of the significant hindrances for a wide introduction of the process in series production is the insufficient acquisition of manufacturing flaws and defects. It is often not possible to examine an SLM component after manufacture without destroying it completely. A first step toward such an examination is to develop suitable methods for process observation, whereby the behavior of the melt during the process should be recorded. For this, investigations have been conducted by means of pyrometry to capture the heat radiation from the laser/material interaction zone.

Method

The process observation unit used is described in more detail in the report »Spatially Resolved High Speed Pyrometry for Selective Laser Melting«. In the pyrometric investigations, the heat radiation of the melt is captured by two pyrometers, and the measuring fields of these pyrometers can be directed toward each other and across from the melt pool position with a precision of down to 20 µm. This does not only enable the heat radiation to be detected coaxially, but also to be done so at staggered positions, which can be optimized to discover defects. For example, measurements right behind the melt pool reduce the signal disturbances caused by melt movements. Furthermore, the use of two pyrometers makes it possible to correlate respective measurements to each other to better detect any defects. To test the suitability of the system, components with predefined defects have been built.

Result

Simulated imperfections with dimensions > 100 µm can be detected by representing the pyrometer signals in a temperature map (Figure 2). Through Fourier analysis of the pyrometric data, distinctions could be made between samples of high density (> 99.5 %) and ones with lower density (> 88 %), although the lower density was caused by many small pores (10 - 30 µm) which could not be resolved individually.

Applications

A system for process monitoring is fundamentally advantageous for the SLM process in all fields of application.

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1 Measurement set-up.

2 Temperature map.