Technology Offer

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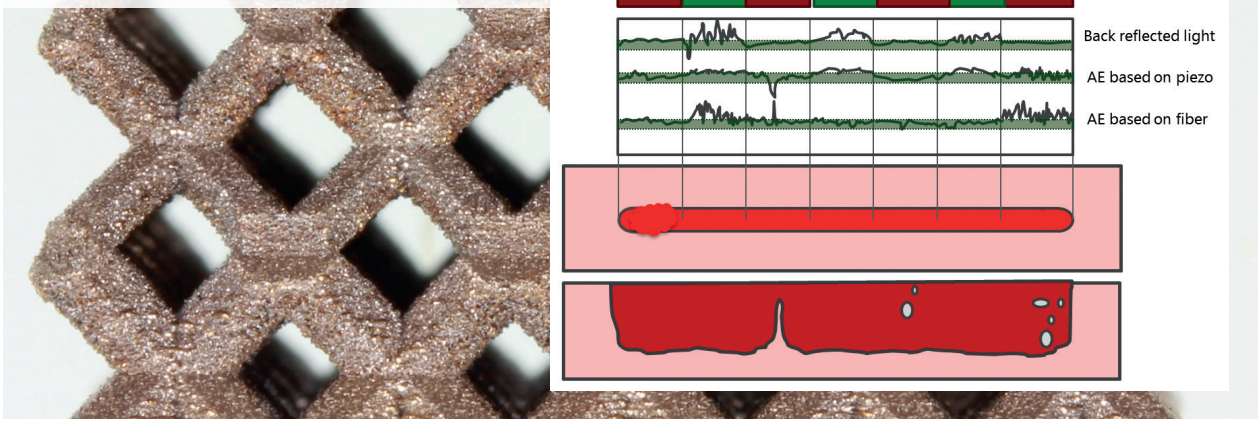
Empa
Materials Science and Technology

Real-time quality control in additive manufacturing



Invention

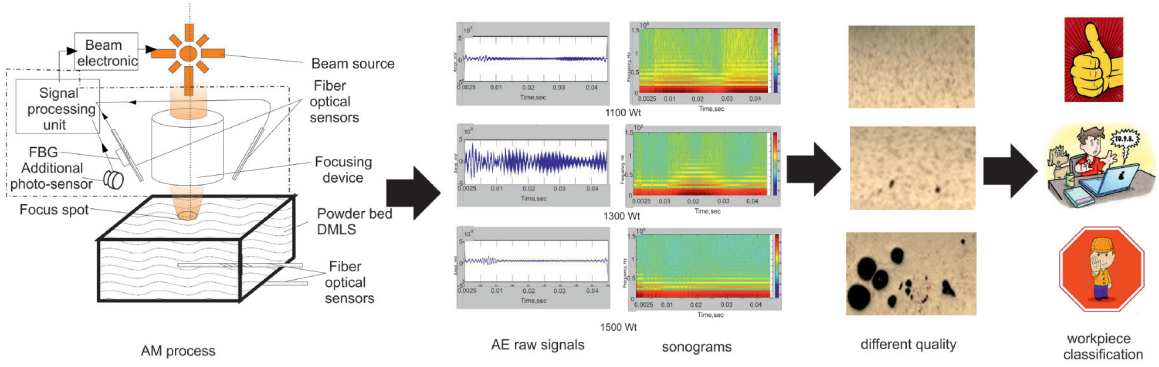
Until now, in additive manufacturing (AM), field quality control has been diligently based on temperature or high resolution imaging of the process zone. For this, various sensors such as pyrometers, photo diodes and matrix CCD detectors were involved. However, there are discrepancies in the temperature measurements, which are all related to their reliability. Furthermore, high resolution imaging controls the quality only post factum, after a part is manufactured. No methods are known so far to monitor the quality of additive manufacturing in real-time. We propose an innovative approach for monitoring the quality of the additive manufacturing process online by means of acoustic emission (AE), detected by fiber optical sensors.

Advantages

The sintering or melting process has a number of unique acoustic signatures that can be detected and interpreted in terms of quality. The combination of such acoustic signatures is related to heat distribution and particles interaction inside the processing zone. The interpretation of AE in terms of process quality is made by Artificial Intelligence (AI) methods. This includes the extraction and recognition of unique acoustic signatures from different sintering or melting events.

Applications

This invention is very versatile and can be easily integrated in any additive manufacturing machine (hardware and/or software) by AM machine producers. It can be also implemented as an add-on to already existing additive manufacturing machines.



The advantages of this invention are twofold. First, the additive manufacturing process of a workpiece can be stopped as soon as the defined quality level is not reached, e.g. when there is porosity in the workpiece. Second, based on the measured signals, the process parameters can be optimized via a self-contained feedback control loop. Therefore, quality control and adaptation of subsequent process parameters are possible.

Ownership

Empa, Swiss Federal Laboratories for Materials Testing and Research, Überlandstrasse 129, CH-8600 Dübendorf [add possible co-owners]; Patent pending

Keywords

In situ, real-time monitoring, additive manufacturing, acoustic emission, artificial intelligence

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