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Abstract

How Micro-CT improves the printing process of AM components

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Computed Tomography (CT) is widely used as reference non-destructive testing method to analyze the inner structure of safety-critical parts especially in heavily regulated industries such as the medical. In particular, additive manufactured (AM) components often with their bionic design will lead to very complex structured parts, which can be light weight and robust at the same time.

Metallic AM components produced in a powder bed fusion process are used for example as implants and could even be tailored to the individual needs of each patient. But such a unique and complex design has the disadvantage that mechanical properties and changes of internal structures are not easily predictable. By using micro computed tomography (µCT) scans, even these complex components can be examined directly with high resolution, which can help understanding a variety of properties of the 3D printed part. Firstly, using the model reconstructed from the CT scan, a local difference between the target and actual object can be determined, which can be caused for example by shrinking during the cooling process. This can be useful to fine tune the component shape on one hand. And on the other hand, when using the integrated monitoring system of the 3D printer, it is essential to know where the predicted defect is located in the real component.

Secondly, also the location and shape of internal structures can be investigated with high accuracy. Again, due to the cooling and other postprocessing procedures the internal composition can change drastically and unpredictable.

And finally, because a µCT System is used, defects in the micrometer range can be detected. But not only single defects or the overall porosity is of importance. By analyzing cluster of defects and their location within the object one can gain insights into mechanical properties and potential fracture points.

In this contribution we will show on several examples how CT imaging can help understand the properties as well as the changes of internal and external structure especially of 3D printed metal components.

AUTHOR'S STATEMENT

Conflict of interest: Authors state no conflict of interest. Animal models: n. a. Informed consent: n. a. Ethical approval: n. a.

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