

# Data Guided Materials Processing - Digital Material Twin and Digital Material Shadow

Jing Wang<sup>1</sup>, Sebastian Wesselmecking<sup>1</sup>, Ulrich Krupp<sup>1</sup>, and Marc Ackermann<sup>1</sup>

<sup>1</sup>Aachen University of Technology University Library

April 4, 2022

## Abstract

In context of industry 4.0, a digital twin provides new opportunities for production optimization and failure prediction. Therefore, both industry and scientific research show increasing interest in digital twins. One of the most important sectors in the production value chain is material science, which plays a very important role for the product properties and processing strategies. However, the digital microscopic and macroscopic description of materials' properties and its processing are currently not fully defined. Therefore, in order to implement materials into the digital representations of production processes, a throughout digital description of the material and its properties – a digital material twin – is presented in this paper. An extended digital material twin is further defined and includes the processing history. Thus, a throughout description of the material is enabled. The extended material twins can be connected to a process chain. Thus, we describe the concept for a comprehensive description of the materials' properties within the production value chain. For more complex, data intensive, descriptions, a concept to reduce the data, the digital material shadow is introduced as well. Our approach defines a framework to thoroughly describe a material and its development during processing or production.

## Hosted file

Digital Material Twin and Digital Material Shadow.pdf available at <https://authorea.com/users/473682/articles/563818-data-guided-materials-processing-digital-material-twin-and-digital-material-shadow>