

GERMANY

IWM-IAPK Colloquium 2023: Sintering-Based Additive Manufacturing – Trends and Developments

Additive or generative Manufacturing (AM) of components is currently attracting a lot of attention. The potential of the processes is addressed by research and development for many industry sectors, with ever new and modified processes being devised. At the same time, the first systems for aviation, medicine and tool-making have made the leap into commercialisation and application.

Besides the laser- and electron-beam-based processes, sintering-based AM processes are gaining increasing interest. In these processes, additive manufacturing is limited to the manufacturing of a green part so that a downstream sintering step is necessary for the consolidation of the material. Especially for many hard materials that cannot be regarded as weldable in the classical sense, these processes present the only possibility for generative manufacturing.

Accordingly, sintering-based processes are suitable primarily for processing ceramic, tool steel or carbides. Moreover, many of these processes offer, on account of their higher printing speed compared to jet-based variants, great potential for lowering manufacturing costs. Not least, most sintering-based AM processes draw on existing know-how and manufacturing equipment for Powder Metallurgy and Technical Ceramics.

This prompted the organisers to arrange the 2023 Colloquium held on 23.03.2023 at the TEMA Pyramide in Aachen under the heading “Sintering-Based Additive Manufacturing – Trends and Developments” at which 80 attendees (Fig. 1) actively discussed different aspects.

Papers

The plenary lecture “Sintering-Based AM Processes – an Overview of Processes, Materials and Applications” was presented by Thomas Weissgärber, Fraunhofer/IFAM Dresden. He concentrated on processes that work with metal powder pastes (MoldJet, gelcasting, 3D screen-printing). Pastes offer advantages compared to a powder bed:

- No extensive parameter study at the machine for the development of new pastes
- High powder loading, so that high green density is possible
- Protection and stabilising of sensitive powders, e.g. titanium, copper, low-alloy steels
- No anisotropy in printing, non-spherical powders can also be processed, use of bimodal powder compositions are possible
- No thermal stresses in the green body during or after printing
- No handling of loose powders, paste is generally water-based.

These processes are essentially still under development. For that reason, tasks like commercialising the plant systems, extending the material palette, digitalizing process data processing, integrating AI for detecting and eliminating defects and simulating the process flow still lie ahead. In addition, the extensive problem of developing nesting and design guidelines tuned to the printing and sintering process must be resolved.

Other speakers provided an overview of a series of different aspects of the topic. Besides the presentation of several process variations for selected material groups, the focus was on concrete, success-critical aspects of the manufacturing chain and simulation models for support for design and process design in the sense of a digital twin:

- Innovative Additive Manufacturing Technologies for Manufacturing High-Performance Ceramics and Carbides – Gerardo Igler, Lithoz GmbH/AT



Fig. 1
Attendees of the IWM-IAPK Colloquium 2023 at the TEMA Pyramide in Aachen

- ColdMetalFusion – The Best of the World of Sintering and Additive Manufacturing Combined – Christian Fischer, Headmade Materials
 - Numerical Methods for Multiscale Prediction of the Sintering Distortion of Additive-Manufactured Components – Oliver Schenk, IWM RWTH Aachen University
 - Metal Binder Jetting as a Complementary Technology for Metal Injection Moulding? – Simone Herzog, IWM RWTH Aachen University
 - 3D Printing of Carbides by Means of Binder Jetting: Properties and Wear – Leonel Pereira, Ceratizit/LU
 - The Digital Twin of Sintering-Based Additive Manufacturing: from Powder to Component – Yuanbin Deng, IAPK/IWM RWTH Aachen University
 - Metal Binder Jetting in Series Manufacture – Potential and Challenges – Dr Patrick Köhnen, GKN Additive
 - Manufacturing of Heavy-Duty Drive Components by Means of Metal Binder Jetting – Lukas Klee, WZL RWTH Aachen University
 - Influence of Powder-Binder Interaction in Metal Binder Jetting – Lea Reineke, Fraunhofer IFAM Bremen.
- The next colloquium is scheduled for 21.03.2024 at the same venue. KS



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