



FRAUNHOFER WORKSHOP ON ADVANCED CERAMIC ADDITIVE MANUFACTURING

PRODUCTION, FUNCTIONALIZATION, QUALITY ASSURANCE, POTENTIAL NEW APPLICATIONS

FRAUNHOFER WORKSHOP SERIES (FWS) are bridging academia and industrial experts to tackle foresighted research into practical solutions. Our FWS events include background lectures, round-tables and hands-on sessions. The goal is to contribute to application-oriented research and to support the transfer of academic research to the industrial domain.

Additive manufacturing (AM) methods allow for fabrication of geometrically highly complex, multi-functional ceramic components made of different materials that could not at all or just at great cost be realized using conventional methods. Due to their working principle, AM methods are very sparing costly raw materials consumption and can be used to produce customized one-offs or small batches. Beyond small batch manufacturing issues concerning quality assurance and overall economic efficiency must first be addressed.

In this workshop, we will investigate various additive manufacturing technologies for ceramic components and ceramic-based multi-material hybrids. We will give insight on how to highly functionalize ceramic components and find out about applicable quality assurance and process optimization measures, also to address challenges and opportunities in times of "Industrie 4.0".

The workshop will include several lectures and sessions to build and improve knowledge in different subtopics:

- The road to ceramic-based additive manufacturing – about the properties of ceramic materials and the know-how to go from conventional ceramic process routes to AM and Hybrid processes
- Challenges and opportunities for industry and academia
- Progress in important ceramic-based additive manufacturing methods: fabrication with filaments (CerAM-FFF), 3D-printing of multi-material components (CerAM-T3DP), selective laser melting (SLM), lithography-based ceramic manufacturing (LCM)
- Quality Assurance: In-line defect detection and optimization opportunities by machine learning methods

When: Wed 25th July, 2018 **Time:** 01:00pm - 06:00pm

Where: PSA Building, Level 7, Geoworks (by SLA), The Geo Hall

 Register at [fraunhofer.sg/fws](https://www.fraunhofer.sg/fws)

 For more information please contact fws@fraunhofer.sg

Organizer:

Fraunhofer Singapore
Contact: Robert Johnne

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Fraunhofer is the leading organization for applied research in Germany and Europe. Over 25.000 highly qualified employees are covering all areas of research and make customized services possible. **Fraunhofer Singapore** is the first Fraunhofer subsidiary in Asia, developing solutions and services that help companies and industries stay ahead of the competition.

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FWS #03

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WORKSHOP PROGRAM

- 12:30 - 13:00 **Registration, tea and coffee**
- 13:00 - 13:10 **Welcome & Introduction**
Prof. Wolfgang Müller-Wittig, Director of Fraunhofer Singapore, Singapore
- 13:10 - 13:40 **AM of Ceramics – Properties, Processing, Functionalization, Hybridization**
Prof. Alexander Michaelis, Director of Fraunhofer Institute for Ceramic Technologies and Systems (IKTS), Germany
- 13:40 - 14:00 **Progress in Ceramic-based Fused Filament Fabrication – CerAM-FFF**
Dr. Hagen Klemm, Head of Department „Processes and Components“, Fraunhofer IKTS, Germany
- 14:00 - 14:20 **Progress in Additive Manufacturing of Ceramics by Selective Laser Melting – SLM**
Mingxuan Gan, PhD-Student, NTU Additive Manufacturing Centre, Nanyang Technological University (NTU), Singapore
- 14:20 - 14:40 **Progress in Ceramic-based Thermoplastic 3D-Printing – CerAM-T3DP**
Axel Mueller-Koehn, Group „Shaping“, Fraunhofer IKTS, Germany
- 14:40 - 15:40 **Coffe break & Networking**
- 15:40 - 16:00 **Quality Assurance in AM: In-line monitoring – Non-Destructive Testing Methods for AM**
Prof. Alexander Michaelis, Fraunhofer IKTS, Germany
- 16:00 - 16:20 **Quality Assurance in AM: Machine learning – Build Control, Detection, Optimization**
Dipl.-Ing. Robert Johnne, Fraunhofer Singapore, Singapore
- 16:20 - 16:40 **Progress in Lithography-based Ceramic Manufacturing (LCM) @ Lithoz GmbH**
Dr. Martin Schwentenwein, Head of Materials Development, Lithoz GmbH, Austria
- 16:40 - 17:40 **Panel discussion with our experts**
Prof. W. Müller-Wittig, Prof. A. Michaelis, Dr. M. Schwentenwein, Dr. H. Klemm
- 17:40 - 18:00 **Closing remarks**
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