

**FRAUNHOFER AT IMTS | SEPTEMBER 10-15, 2018  
EXHIBITS AND PROGRAM**

**MANUFACTURING THE FUTURE  
THE EVOLUTION OF INDUSTRIE 4.0**





## FRAUNHOFER AT IMTS 2018

The future and prosperity of entire countries depend on the production of goods, just as many jobs in the USA and worldwide. The future of digitalized manufacturing and Industrie 4.0 rests entirely upon the ability to pool expertise and resources.

Fraunhofer's interdisciplinary systems expertise sparks the new ideas that meet the challenges of a changing world and helps create customized solutions right along the value chain. Visitors to the Fraunhofer booth on this year's International Manufacturing Technology Show IMTS in Chicago can experience how a vibrant mix of new technology in the fields of augmented reality as a service, artificial intelligence, cybersecurity and data sovereignty, sensor and actuator systems, digital engineering, human-machine interaction and smart materials is reshaping the future.

## EXHIBITS

# SMART PRODUCTION



■ Fraunhofer Institute for Ceramic Technologies and Systems IKTS

### **Miniaturized detector in ceramic LTCC technology for early warning systems**

Miniaturized sensor concepts based on ceramic multilayer technology and chip solutions with hermetically sealed packaging are shown, which allow seamless monitoring of critical structures and processes even under high temperatures up to 500 °C, aggressive media/chemicals and/or mechanical stress.

[www.ikts.fraunhofer.de/en](http://www.ikts.fraunhofer.de/en)

■ Fraunhofer Institute for Electronic Nano Systems ENAS

### **Structure integrated wireless sensor/actuator technology for manufacturing systems**

The demonstrator shows approaches for structure integration of sensors into manufacturing systems, using a ball screw drive as an example. New challenges had to be faced in order to achieve a process-controlled in-situ condition monitoring at hardly accessible positions inside machines and constructions. Hence, miniaturized, cross-linked, and energy-efficient information and communication technologies had to be integrated into drive mechanisms and tool components.

[www.enas.fraunhofer.de/en](http://www.enas.fraunhofer.de/en)

■ Fraunhofer Institute for Production Technology IPT

### **5G data transmission in production**

For the world's first live transmission of machining data from a high-performance milling machine via the new 5G radio standard, Fraunhofer IPT and Ericsson have equipped a workpiece with smart sensor and radio technology. With its high transmission rates and extremely short latency times, the wireless connection meets the high demands for stable and reliable communication in production and enables process visualization and data analysis in real time.

[www.ipt.fraunhofer.de/en](http://www.ipt.fraunhofer.de/en)

■ Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI

### **Real-time layer thickness measurement with terahertz**

Terahertz is a key technology for non-destructive material testing. Major advantages are examinations without physical contact and the analysis of complex systems with a low contrast range in which established methods like ultrasonic usually fail. Fraunhofer HHI has successfully developed a cost-efficient and compact measurement system that conducts real-time measurements of the thickness of multi-layer systems for the first time, an essential technology e.g. for lacquering lines.

[www.hhi.fraunhofer.de/en](http://www.hhi.fraunhofer.de/en)

## EXHIBITS

# SMART PRODUCTION

■ Fraunhofer USA Center for Coatings and Diamond Technologies CCD

### **Nanolayer coated spindle punches OR / diamond-like-carbon coated cutting and forming tools**

Experience coated spindle punches for hot forging that see a 200% increase in tool life and can withstand operating temperatures of 1950 °F. These coatings ensure predictable usability for three uninterrupted production shifts for tool utilization in smart manufacturing environments.

[www.ccd.fraunhofer.org](http://www.ccd.fraunhofer.org)

■ Fraunhofer USA Center for Coatings and Diamond Technologies CCD

### **Diamond-like-carbon coated cutting and forming tools**

Examples of diamond-like-carbon coated cutting and forming tools to machine and form non-ferrous materials are presented: Such coatings reduce tool wear and enable predictability of tool utilization in smart manufacturing environments.

[www.ccd.fraunhofer.org](http://www.ccd.fraunhofer.org)

■ Fraunhofer USA Center for Manufacturing Innovation CMI

### **Machines that enable smart manufacturing**

Fraunhofer CMI develops smart, sensor rich automation that generates the data for machine learning and analytics. A video will show short clips of various custom designed, highly sensorized, flexible automated machines that CMI developed for customers.

[www.cmi.fraunhofer.org](http://www.cmi.fraunhofer.org)



## EXHIBITS

# IT SOLUTIONS

### ■ Fraunhofer Institute for Computer Graphics Research IGD

#### **AR and VR for maintenance, assembly and engineering**

Technical systems like machines are becoming more and more complex and individual. Previous approaches to repair processes are often no longer sufficient. The industry therefore is looking for new solutions. Our mixed reality approaches allow 3D engineering data to be optimally combined with maintenance systems and processes to substantially reduce the efforts in creating and implementing such technical instructions or even to make their creation and implementation possible.

[www.igd.fraunhofer.de/en](http://www.igd.fraunhofer.de/en)

### ■ Fraunhofer Institute for Manufacturing Engineering and Automation IPA

#### **Smart optimization of complex production lines**

AI-based production optimization for complex and fully automated production lines: Several industrial use cases have proven 10% productivity increase in the automotive, pharmaceutical and consumer goods production sector. The software package learns a behavior model of the complete production line and derives problems and suspicious events in real-time. Feedback and allocated root-causes of problems are communicated by smart devices to operators.

[www.ipa.fraunhofer.de/en](http://www.ipa.fraunhofer.de/en)

### ■ Fraunhofer Institute for Production Systems and Design Technology IPK

#### **Flexible control systems for smart factories**

The modular shopfloor IT allows simple, fast, flexible and across-the-trades development, implementation and maintenance of shopfloor IT ("Plug & Produce"). In combination with the "digital twin" which mirrors the structure and behavior of entire production plants, early plant adjustments for the production of newly developed products can be easily realized all the way to fault-free production operation.

[www.ipk.fraunhofer.de/en](http://www.ipk.fraunhofer.de/en)

### ■ Fraunhofer-Cluster of Excellence Cognitive Internet Technologies

### ■ Fraunhofer Institute for Software and Systems Engineering ISST

#### **Data sovereignty within the Cognitive Internet**

Cognitive Internet Technologies build a bridge between the physical world, the digital world and the social world (the users). They are key for digital sovereignty and economic competitiveness. In the cluster of this name Fraunhofer concentrates its research on IoT communications, data rooms and machine learning. The great importance of data rooms in this context is demonstrated by the "Industrial Data Space City" at the IMTS.

[www.cit.fraunhofer.de](http://www.cit.fraunhofer.de)

[www.isst.fraunhofer.de/en](http://www.isst.fraunhofer.de/en)

## EXHIBITS

# IT SOLUTIONS

### ■ Fraunhofer USA Center for Experimental Software Engineering CESE

#### **Cyberphysical Industrie 4.0 cybersecurity testbed**

Fraunhofer CESE will demonstrate a cyberphysical Industrie 4.0 testbed designed for prototyping of security solutions for critical infrastructure systems and industrial manufacturing operations. The testbed will implement a set of common industrial sensors and communications protocols, and offer a traditional SCADA operator interface for data collection and sensor actuation.

[www.cese.fraunhofer.org](http://www.cese.fraunhofer.org)

**Learn more about digitalized  
manufacturing:  
[http://s.fhg.de/digitalized-  
manufacturing](http://s.fhg.de/digitalized-manufacturing)**



## EXHIBITS

# ADDITIVE MANUFACTURING



### ■ Fraunhofer Institute for Laser Technology ILT

#### **Brake disk coated with EHLA process**

The exhibit shows a brake disc coated with a high speed cladding process – a technique awarded with the Fraunhofer science prize. It stands for improvement of the wear resistance of brake discs (the cast iron component, very challenging to weld) with laser material/high speed laser material deposition with very small layer thicknesses and extremely low heat input.

[www.ilt.fraunhofer.de/en](http://www.ilt.fraunhofer.de/en)

### ■ Fraunhofer Institute for Laser Technology ILT

#### **Printed and laser-functionalized sensors on components**

Integrated sensors enable embedded mechanical and thermal monitoring of components in the field of structural health monitoring (SHM) for the detection of defective elements as well as the collection of machine or product-relevant data. The Fraunhofer ILT manufactures these sensors using printing and laser functionalization technologies. These digital, inline-capable processes enable the flexible production of a variants without adaptation of tools or masks.

[www.ilt.fraunhofer.de/en](http://www.ilt.fraunhofer.de/en)

### ■ Fraunhofer Institute for Laser Technology ILT

#### **μ-LPBF components**

Laser powder bed fusion (L-PBF) manufactured demonstrators using pulse modulation are presented, reaching worldwide unmatched resolution and surface quality.

[www.ilt.fraunhofer.de/en](http://www.ilt.fraunhofer.de/en)

### ■ Fraunhofer Institute for Material and Beam Technology IWS

#### **Combustion chamber with swirl injectors**

We present a hybrid manufactured combustion chamber by laser metal deposition (LMD) with powder. Demonstration of LMD potential for the extension of existing parts, swirl injectors by SLM Material: 316L (chamber), Ti6Al4V (injectors).

[www.iws.fraunhofer.de/en](http://www.iws.fraunhofer.de/en)

### ■ Fraunhofer Institute for Material and Beam Technology IWS

### ■ Fraunhofer USA Center for Laser Applications CLA

#### **Laser processing head COAX 4.0**

A laser processing system for direct metal deposition is shown, suitable for industrial applications in surface cladding and additive manufacturing. It is a regulated and self-controlled system for intelligent, networked laser processes.

[www.iws.fraunhofer.de/en](http://www.iws.fraunhofer.de/en)

[www.cla.fraunhofer.org](http://www.cla.fraunhofer.org)

# EXHIBITS

## ADDITIVE MANUFACTURING

- Fraunhofer Institute for Silicate Research ISC
- Fraunhofer Project Group Materials Recycling and Resource Strategies IWKS

### **Rare earth metals: magnet, demonstrator, electric engine**

Rare earth metals are used in modern electric motors, wind power generators, smartphones and energy-saving lamps. A sustainable and networked future does not seem conceivable without it. The objectives of the lead project "Criticality of Rare Earths" are the increase of resource efficiency, the recycling and the substitution of the rare earths in high performance magnets. Improvements enabled companies to achieve performance improvements/savings of around 50%.

[www.isc.fraunhofer.de/en](http://www.isc.fraunhofer.de/en)

[www.iwks.fraunhofer.de/en](http://www.iwks.fraunhofer.de/en)



## PROGRAM MONDAY, SEPTEMBER 10TH

Venue: Solutions Theater

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### Fraunhofer experts at IMTS

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- 9.30 – 10.15 a.m. **Panel discussion: public policies**  
Prof. Reimund Neugebauer  
President of the Fraunhofer-Gesellschaft
- 3.30 – 4.15 p.m. **Industrie 4.0 meets IIoT: security panel**  
Prof. Boris Otto, Fraunhofer Institute for Software and Systems Engineering ISST
- 4.20 – 4.50 p.m. **Industrie 4.0 meets IIoT: testbed live session**  
BaSys 4.0, Basissystem Industrie 4.0  
Prof. Peter Liggemeyer, Fraunhofer Institute for Experimental Software Engineering IESE

## PROGRAM TUESDAY, SEPTEMBER 11TH

Venue: Solutions Theater

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### Fraunhofer: Manufacturing the future

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- 11.00 – 11.20 a.m. **AI-based production optimization for interlinked manufacturing process chains: autonomous production optimization**  
Thomas Hilzbrich, Fraunhofer Institute for Manufacturing Engineering and Automation IPA
- 12.30 – 12.50 a.m. **Modular shopfloor IT interconnects heterogenous digital twins**  
Prof. Thomas Knothe, Fraunhofer Institute for Production Systems and Design Technology IPK
- 2.00 – 2.20 p.m. **Integration and application of process sensors in complex adaptive manufacturing systems**  
Moritz Frauendorf, Fraunhofer Institute for Machine Tools and Forming Technology IWU
- 3.30 – 3.50 p.m. **AM gives a boost to industrial production: from complex shapes to large-scale components**  
Prof. Christoph Leyens, Fraunhofer Institute for Material and Beam Technology IWS



**PROGRAM**  
**WEDNESDAY, SEPTEMBER 12TH**

**Venue: Solutions Theater**

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**Fraunhofer experts at IMTS**

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10.00 – 12.00  
a.m. **Expert session “Smart Manufacturing”  
hosted by VDMA**

**Digital photonic production: perspectives  
on tomorrow’s world of individualized &  
smart industrial products**

Prof. Johannes Schleifenbaum, Fraunhofer  
Institute for Laser Technology ILT

**Future of maintenance – knowledge-based  
and data-driven maintenance strategies**

Prof. Wilfried Sihm, Fraunhofer Austria

**PROGRAM**  
**SATURDAY, SEPTEMBER 15TH**

**Venue: Solutions Theater**

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**Fraunhofer: Manufacturing the future**

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11.00 – 11.20  
a.m. **Virtual power train manufacturing –  
global Fraunhofer network**  
Dr. Marco Kampka, Fraunhofer Center for  
Manufacturing Innovation CMI

12.30 – 12.50  
a.m. **Biological Transformation – Fraunhofer  
goes beyond**  
Prof. Fritz Klocke, Fraunhofer Institute for  
Production Technology IPT



**VISIT US AT**  
**WWW.FRAUNHOFER.DE/IMTS**

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### **Editorial notes**

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### **Venue**

International Manufacturing Technology Show IMTS

Chicago, Illinois, USA

McCormick Place, East Building, Level 2

**Fraunhofer booth at IMTS:** Booth No. 121815

**Solutions Theater at IMTS:** Booth No. 121847

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