TOPIC AREA "*CAST*$^{TRONICS®}$ – DIGITALIZATION OF CASTINGS"

The digitalization of metal castings

The *CAST*$^{TRONICS®}$ technology enables the embedding of electronic functional components in metal castings, opening the way for castings with a higher functionality than ever before, so-called "smart castings". These form the basis for the digitalization of the manufacture and use of castings and further offer novel possibilities, for example for the **identification and tracking of castings** through embedded RFID transponders or for the **monitoring of castings** through embedded sensors.

At Fraunhofer IFAM, **RFID transponders** are cast into components, allowing an electronic, radio-based marking and **identification of cast products**. The RFID transponder can be applied to already existing castings and even directly embedded into the component during the casting process with the patented *CAST*$^{TRONICS®}$ technology.

Embedded **sensors** enable the identification, measurement, and assessment of any mechanical loads such as compressive and tensile forces, deformations, and vibrations. Particularly for the **autonomous driving** this technology offers new ways to **detect misuse loads at an early stage** and can thus prevent excessive loading that would cause the casting to fail.

CONTACT

Christoph Pille
Group Leader *CAST*$^{TRONICS®}$ – Digitalization of Castings
Casting Technology and Lightweight Construction
Phone +49 421 2246-227
casting@ifam.fraunhofer.de

Franz-Josef Wöstmann
Head of Department
Casting Technology and Lightweight Construction
Phone +49 421 2246-225
casting@ifam.fraunhofer.de

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM
Wiener Strasse 12
28359 Bremen, Germany

www.ifam.fraunhofer.de
www.ifam.fraunhofer.de/gt

Fraunhofer IFAM

FRAUNHOFER INSTITUTE FOR MANUFACTURING TECHNOLOGY AND ADVANCED MATERIALS IFAM

CASTING TECHNOLOGY AND LIGHTWEIGHT CONSTRUCTION

TOPIC AREA "*CAST*$^{TRONICS®}$ – DIGITALIZATION OF CASTINGS"

Focus Points in the Topic Area "*CAST*$^{TRONICS®}$ – Digitalization of Castings"

RFID marking of castings

- Embedding of RFID transponders during the high-pressure die casting process
- Subsequent marking of castings
- Consultancy for the use of RFID technology with metal castings
- Robust, process-safe autoID solutions

Traceability of castings

- Unique marking, identification and traceability of castings over their whole lifecycle – starting from the die
- Enables the creation of a digital shadow – necessary for the digital twin

Counterfeit protection against plagiarism in castings

- Digital genuineness certificate through the integrated RFID
- Prevention of grey-market products

Condition monitoring of castings

- Embedding of sensors in aluminum casting
- Measurement of elongation, deformation or breaks in the casting
- Detection of misuse loads and overload

Castings for autonomous driving

- Early detection of material fatigue
- Protection from overloading and component failure for safety-relevant castings
- Collection and provision of usage profiles for decentralized maintenance scheduling

From the concept to the product…

With our competencies in Casting Technology, Fraunhofer IFAM accompanies our industrial customers throughout the casting technology implementation of an idea from the concept to the first prototype to the final series-ready product. We have various casting processes and materials ready to address any query.

… in our one-stop shop!

The Casting Technology and Lightweight Construction department can illustrate the entire process chain from the concept phase via the casting design to the tool construction and the casting technological manufacture to the final metallographical and nondestructive testing.

Novel technology combinations

In addition to the conventional casting technological queries we also support our customers when it comes to reaching across technologies into manufacturing and materials technology. For this, project teams from various departments at Fraunhofer IFAM as well as other institutes of the Fraunhofer-Gesellschaft will come together to combine their expertise. Such topics as corrosion, surface treatment, paint and lacquer technology or adhesive bonding technology can be scientifically and practically addressed through our comprehensive network of research and development staff.

An overview of our services

- Technology consulting for the processes of high-pressure die-casting, low-pressure die-casting, lost foam casting and investment casting
- Experimental research and development
- Feasibility studies and market analyses
- Error and process analyses
- Quality testing and analytics

Our research topics

- Complex castings
- Castings for electric drives
- Hybrid casting and fiber integration
- Digitalization of castings through the integration of RFID transponders and sensors

Technological equipment

- HPDC: 660t BÜHLER SC/N 66 + 250t FRECH DAK 250-34
- LPDC: TEGISA I (50 liters melt volume)
- LPDC: TEGISA II (110 liters melt volume)
- Investment casting: INDUTHERM VC 650 + INDUTHERM VC 3000 D
- Wax injection casting: ModTech C20
- Lost foam casting: VULCAN compaction unit Vector-Flo

Analytics

- X-ray and computer tomography: YXLON MU-2000
- Optical measurement system: GOM ATOS 3 TripleScan
- Complete range of metallographical testing at Fraunhofer IFAM