



PRESS BRIEFING FEBRUARY 15 2018

“Fourth Industrial Revolution: Critical Semiconductor Sub-Systems providing the missing link to Future Data Analytics”

Munich/Nuremberg, February 2018 – Fraunhofer-Gesellschaft and Edwards, the leading developer and manufacturer of sophisticated vacuum, abatement and subfab system solutions and services for the semiconductor industry, are launching a cooperation within Munich-based high performance center “Secure Connected Systems” (www.svs.bayern.de). The goal of the cooperation is to create an advanced performance characterization setup for predictive maintenance of subfab equipment as a reference for Industry 4.0 applications.

Edwards is joining forces with the Fraunhofer research institutions AISEC, EMFT and ESK, with combined expert knowledge in the field of secure and reliable sensor networks. The cooperation involves research, development and evaluation of specific sensor and IoT technologies, with the aim of generating and securing high-quality data to feed advanced analytics. Key is the research on the correlation between process and pump behavior to be piloted in the semiconductor cleanroom environment of Fraunhofer EMFT with a key role played by Edwards’ next generation EdCentra data platform.

Exploring Industry 4.0 scenarios

The joint project of the Fraunhofer high performance center “Secure Connected Systems” in Munich with the industry partner Edwards focusses on the realization of predictive maintenance in the specific application of semiconductor production. In order to deliver efficient and effective service support of high-value assets, in this case vacuum pumps in a semiconductor manufacturing environment, predictive maintenance techniques, such as equipment health prediction and correlation with process conditions, are essential.

The Fraunhofer EMFT 200 mm CMOS line together with the long established knowledge of the staff in semiconductor processing provide an excellent environment to study equipment and related process performance and validate advanced analytics

Contact: Franz Wenninger | Fraunhofer EMFT | Phone +49 89 54759-447
Franz.Wenninger@emft.fraunhofer.de

Press: Pirjo Larima-Bellinghoven | Fraunhofer EMFT | Phone +49 89 56795-542
Pirjo.Larima-Bellinghoven@emft.fraunhofer.de



and machine-learning solutions. The expertise of the Fraunhofer institutes ESK and AISEC in secure communication technologies is an important asset, enabling secure, flexible solutions for 'connected' fabs.

Press Briefing
February 15 2018
Page 2

The implementation steps within the project include for example the development of a sensor setup at the Fraunhofer EMFT cleanroom equipment for acquiring data from various sources within the infrastructure, as well as the preparation of a connected sensor node network, including a secure Internet of Things (IoT) infrastructure.

Smart and cognitive maintenance

Novel Machine Learning techniques will be used to detect anomalies in sensor data. For this purpose, data fusion of several sensor data for combination and pattern recognition, as well as software algorithms for detection of specific states of instability are needed. The aim is to improve the process of predictive maintenance by exploring new machine learning algorithms fed with sensor data from above and below the cleanroom floor, to predict future performance and anomalies. Another important aspect is the use of secure, highly reliable wireless communication between equipment, taking into account factors such as energy consumption, data throughput and the unique nature of the semiconductor manufacturing environment.

A secure connection will be implemented to allow data, machine learning models and equipment status to be exchanged in real-time between secure locations: on premise at the Fraunhofer EMFT CMOS line, and remote in the cloud or Edwards HQ. As well as reducing response time for service, this simplifies analytical model development and deployment. The aim is to demonstrate a new reference architecture, consistent with the principles of Industrial 4.0, but tailored to the unique IP concerns of the semiconductor industry. Sensor data from different entities within the fab can be stored in a secure data space that can scale upwards from a single tool or bay, to meet the needs of customers operating globally, but access to this data, and the movement of it, is restricted by applying single set of access rights and distinct policies.

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Fraunhofer

EMFT

Fraunhofer high performance centre “Secure Connected Systems” will demonstrate a smart maintenance solution at the **Embedded World Exhibition & Conference in Nuremberg from 27th of February to 1st of March 2018 in Hall 4, Booth 470.**

Press Briefing
February 15 2018
Page 3

About:

Edwards is a leading developer and manufacturer of sophisticated vacuum products, abatement solutions and related value-added services. Our products are integral to manufacturing processes for semiconductors, flat panel displays, LEDs and solar cells; are used within an increasingly diverse range of industrial processes including power, glass and other coating applications, steel and other metallurgy, pharmaceutical and chemical; and for both scientific instruments and a wide range of R&D applications.

The **Fraunhofer-Gesellschaft** is the leading organization for applied research in Europe. Its research activities are conducted by 69 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of 24,500, who work with an annual research budget totaling 2.1 billion euros. Of this sum, 1.9 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft’s contract research revenue is derived from contracts with industry and from publicly financed research projects. International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.

The **high performance center “Secure Connected Systems”** offers a platform for digitization in the priority areas of mobility and networked transport systems, industrial automation and smart home/smart health. It provides an application-oriented and interdisciplinary platform for systematic, cross-sector and cross-disciplinary research and collaboration. Participating companies benefit from the networks and technical excellence of the Technical University of Munich, the University of the Federal Armed Forces, the Fraunhofer Institutes AISEC, EMFT and ESK, as well as associated industrial partners. The center is open to cooperation with other research institutions, to further

Contact: Franz Wenninger | Fraunhofer EMFT | Phone +49 89 54759-447

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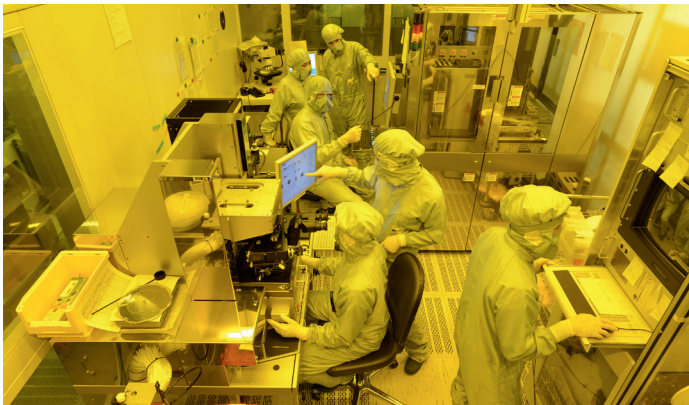
Press: Pirjo Larima-Bellinghoven | Fraunhofer EMFT | Phone +49 89 56795-542

Pirjo.Larima-Bellinghoven@emft.fraunhofer.de



develop the network of cooperating organizations. The high performance center is supported and financed by the Bavarian State Ministry for the Economy and Media, Energy and Technology, the Fraunhofer Gesellschaft, and by industrial partners involved in joint projects.

Press Briefing
February 15 2018
Page 4



Development of algorithms for predictive maintenance and process correlation for vacuum pumps of the semiconductor technology. © Fraunhofer EMFT/Bernd Müller



Edwards iMX 8000 vacuum pump. © Edwards Ltd. 2018

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