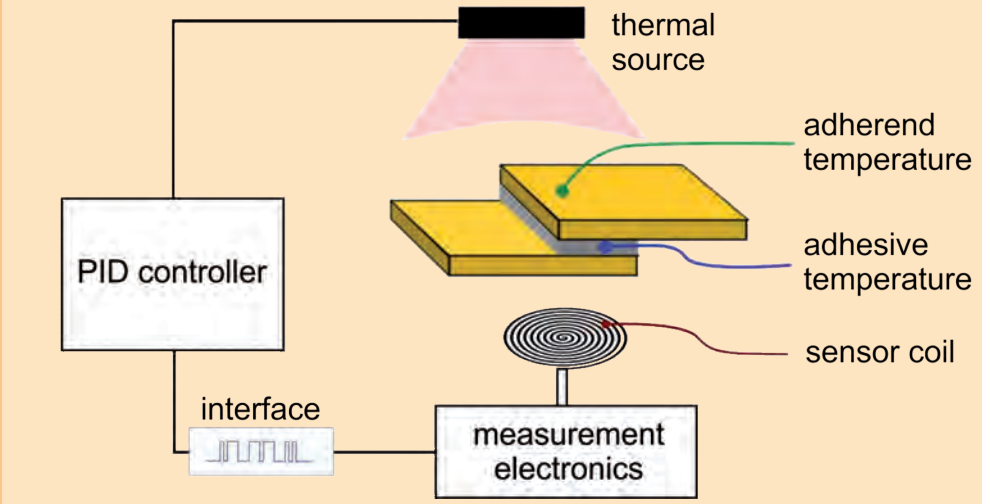

RESEARCH AND DEVELOPMENT

- **SMART DIGITAL PRODUCTION**
- **SENSOR SYSTEMS FOR PROCESS AND CONDITION MONITORING**

TECHNOLOGIES AND SYSTEMS FOR
SMART PRODUCTION

DIGITAL MANUFACTURING IN MASS PRODUCTION

Beyond Industry 4.0 (automation and digitalization of manufacturing), the markets are looking for technologies to mass manufacture customized and individualized products. To provide the industry with the needed technologies a new innovative Fraunhofer project called "Go Beyond 4.0" was granted in 2016.

The concept is to integrate digital manufacturing processes like inkjet printing and laser manufacturing modularly in existing mass manufacturing environments. With this concept, the manufacturing of a huge variety of products can be mass manufactured down to batch size one.

Within the project, digital manufacturing in mass production will be demonstrated in three applications which addresses the major markets automotive, aerospace and lighting: smart door, smart wing and smart luminaire.

The Fraunhofer Institute for Electronic Nano Systems ENAS coordinates the consortia consisting of the Fraunhofer Institutes ENAS, IFAM, ILT, IOF, ISC and IWU. These institutes are leaders in the areas of mechanical engineering, digital printing, electro technique, photonics and material sciences.

www. go-beyond-four-point-zero.de

WIRELESS SENSOR SYSTEM FOR MEASURING OF ADHESIVE TEMPERATURES

In industry more and more product components are assembled by adhesives. At room temperature adhesives usually need several hours or days to cure. By heating up the adhesive this time can be significantly shortened to some seconds or minutes. The material dependent ideal temperature variation for curing must not exceed an interval of ± 10 °C, otherwise the quality of the junction decreases dramatically. Therefore, the knowledge of the temperature of the adhesive is essential for the control system to obtain an optimal curing process. To measure wirelessly the adhesive's temperature, an inductive measurement technique has been developed and tested. By using magnetic sensitive particles as filling material for the adhesive and the corresponding Curie effect, the temperature dependent permeability of these sensor particles can be measured, giving direct information about their temperature. With an appropriate mixture of ferrites a temperature span from 135 to 170 °C can be monitored. Within this span the inductance of a suitable coil sensitively changes and gives reliable information about the curing temperature.

WIRELESS SENSOR SYSTEM FOR STRUCTURAL HEALTH MONITORING

To support the industry with smart production technologies a radio frequency identification transponder (RFID tag) for a structural health monitoring application of industrial rubber belts was developed. These belts are widely used for power transmission applications or for goods transportation in various industries. Integrated RFID tags can help to optimize the logistic value chain and to sense and transmit wirelessly the changes in physical parameters of the rubber belts.

The scientific challenges are related to the required reliability of the wireless sensor functionality. Especially various issues such as unknown dielectrical parameters of rubber materials, bending effects and high-temperature vulcanization of rubber belts become a challenge. Besides, a coped challenge was to overcome damages of the RFID tag itself during the integration into a rubber belt by vulcanization. Another solved challenge was to design an optimized antenna which is able to work inside a rubber belt of unknown dielectric material properties. For simulation of the antenna properties a 3D model was used.