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Terahertz in Industry: Technology and Application

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Terahertz technologies have long been developed and applied in mostly scientific contexts. One of the main reasons was the novelty of this field of research and development and therefore a natural competition with other established techniques in relevant fields of application. In the recent past, however, a number of terahertz measurement technologies have successfully made the transition from mere scientific background into industrial application markets. System core components such as terahertz sources and detectors, quasi-optical components, etc. have become increasingly efficient, relatively compact, and unit prices have dropped to levels where industrial applications become financially attractive.

At Fraunhofer ITWM, as part of the Fraunhofer Society Germany, research and development focuses on terahertz technologies for real-world applications in industry. In particular, techniques of nondestructive testing (NDT) with terahertz technology are implemented in industrial environments addressing not only the terahertz equipment and measurements alone but also typical challenges when working in industrial environments. In this contribution we present a number of specific projects where terahertz technology has already been successfully implemented in industrial processes. Several terahertz technologies such as time-domain spectroscopy (TDS) – mainly for layer thickness measurements – as well as all-electronic terahertz frequency-modulated continuous wave (FMCW) radars – mostly for defect detection and quality inspection – and some recent optoelectronic approaches are presented. We also show first steps towards machine learning-based optimization of measurement processes and automated data evaluation to support the industrial tasks at hand.

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