

The Place of Nondestructive Testing and Characterization in the Manufacturing Chains Modified under the Effect of Industry 4.0 and 5.0 Approaches

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Non-destructive methods have potential for characterization of material properties either in situ or on pieces by sensing the variations of the physical characteristics. Various non-destructive methods have been used to detect surface and internal flaws, to characterize microstructure, to determine mechanical properties and residual stress of the components, and also for long-term monitoring and short-term assessment of materials to prevent failures.

Industry 4.0 and 5.0, two recent conceptual shifts in production, force manufacturers to adopt new technologies in order to significantly increase productivity and efficiency by taking into account smart factories, robotics, computer-based systems, big data, artificial intelligence, machine learning, etc.

Non-Destructive methods, that can serve as industrial sensors and quality control tools, have the potential to be integrated into digitally optimized process chains and thus can provide real-time data on material, product, and process changes. Full integration of NDE into production lines will provide a fast/reliable data collection and analysis tool for verifying the accuracy and performance of the processes and products. Process/product improvement and quality control can benefit from innovative developments in non-destructive methods and their integration with artificial intelligence/machine learning methodologies. Moreover, hybrid technologies combining several ND methods may provide Industry 4.0 and 5.0 with data on material showing the variations in product, and process, and thus, remarkably contribute to digitally optimized process chains.