

Workshop »Digital Data creates value – recognising and exploiting opportunities«

Plasma Coating Process Enhancement using AI and Data Science

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The modern manufacturing industry, also known as industry 4.0, has manufacturing setups with different peripherals, such as temperature sensors, pressure sensors, vision sensors, internet connectivity interfaces and data storage interfaces, and similar is the case with Bosch's coating business. All these peripherals give rise to different kinds of data when the coating process is in execution. This raw data is in bulk due to a large-scale coating process and is stored actively in a database or data lake under a specific scheme for better analyzation, understanding and ease of fetching information.

The focal objective is to model the relationship between process parameters and mechanical properties of the coating process. So, with the help of this model, it can be estimated what kind of value combination of process parameters results in what kind of mechanical properties. The anticipated benefits of this modeling are reduction in engineering effort, reduced cost, improved quality, and enhancement of the overall coating process.

A state-of-the-art methodology is proposed in our work to fulfill the focal objective and it is based on artificial intelligence and data science. We utilize the raw data collected from the real-world coating process, engineer this raw data, and then use this data to train a neural network, in a supervised learning construct based on deep learning and machine learning principles. Our trained neural network decodes the underlying process parameter pattern and acts as the model that can predict mechanical properties in advance, such as coating thickness.

We evaluate the performance of our model on test coating batches, by comparing the thickness predictions made by our model with the actual coating thickness results from production. Comparison plots and performance metrics demonstrate that our model learns the underlying pattern from the training data and makes predictions of the coating thickness within the thickness tolerance limits for most test coating batches.