

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

### Examples of synergistic process simulation, data mining and machine learning in PVD and PECVD

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This presentation focuses on the use of **process simulation, machine learning, and data mining techniques in the plasma coating industry**, specifically within the PVD and PECVD processes. Through case studies and specific examples, we will illustrate how these modern techniques have been applied to increase the reliability and reproducibility of existing processes, as well as design new processes altogether.

The first case study involves the **prediction of material composition and hardness of a decorative coating** through the integration of physics simulation and machine learning. By applying a machine learning technique heavily constrained by physics rules, we are able to predict the composition, deposition rate and hardness of TiAlSiN coatings based on 8 training experiments. Thanks to the integrated physics model the algorithm even provides reliable predictions outside the training dataset.

The second case study demonstrates how simulation can **predict coating structure on complex 3D parts and aid in the design of fixtures** to improve uniformity. Specifically, we will examine the **differences in deposition profiles for DC sputtering, arc evaporation, and HiPIMS** processes, highlighting the capabilities of simulation in troubleshooting mass-production challenges.

Lastly, we will discuss a **simulation-guided development** approach that played an important role in the creation of a **novel PECVD technology for silicon dioxide deposition on glass**. This technology has the potential to revolutionize the industry by providing a cost-effective and efficient way to deposit silicon dioxide.

In summary, this presentation offers a technical examination of the cutting-edge techniques being used in the plasma coating industry. Attendees will gain valuable insights into how process simulation, machine learning, and data mining can be leveraged in our industry to optimize existing processes and develop new ones.