Effects of Surface Morphology of SLM-printed Parts on the Coating Quality

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Complex geometric patterns of catalyst support structures can be optimized to intensify and enhance chemical reactions. The corresponding metal prototypes can be manufactured e.g. by using selective laser melting (SLM) technology. Where the reactions are promoted by catalyst layers, achieving a stable coating on the metal substrates is crucial. A reliable washcoated layer offers potential advantages over traditional catalyst particles or pellets, including lower pressure drop [1]. Nonetheless, washcoating metal substrates is a demanding procedure due to morphology considerations. The rough surface of SLM-printed components is often viewed as a poor surface quality and therefore a concern for manufacturers, as roughness can lead to crack initiation in the metal parts under static or fatigue loading [2]. However, in the context of catalytic coating, surface texture and in particular roughness can be additionally helpful to enhance the ceramic-metal adhesion [3]. In this study, different surface features generated by SLM process of a stainless steel alloy (316L) are investigated and discussed based on their influence on the coating quality. Adhesion stability and uniformity of the coating were the main objectives.

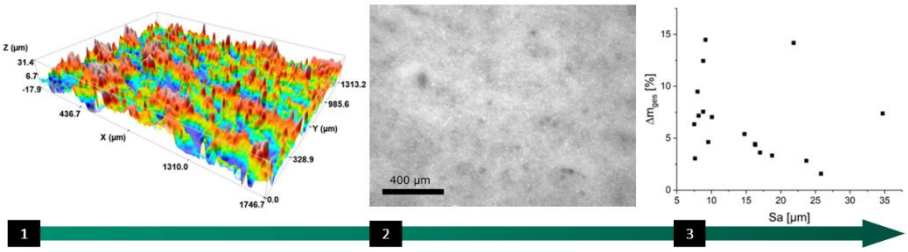

Figure 1: (1) Microscopy characterizations, (2) Washcoating SLM-printed samples, (3) Adhesion test results in correlation with roughness of SLM-printed samples.

[1] S. Irandoust., & B. Andersson., Catalysis Reviews, 1988, 30(3), 341-392.
[2] Z. Fielden-Stewart *et al.,* International Journal of Adhesion and Adhesives, 2021, volume 105, 102779.
[3] F. Mehdipour *et al.,* Catalysis Communications, 2024, volume 187, 106873.