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TECHNISCHE UNIVERSITÄT DARMSTADT

PhM

Topic description

Bachelor and Master Thesis, ARL

DFG Project:
Direct and indirect nanostructuring for functionalization of metallic surfaces

The project aims to investigate the functional surface properties of metallic materials influenced by microtopographic surface structuring. Therefore, comparing the process limitations, material influence and surface functionalization of indirect and direct surface structuring methods is of great interest.

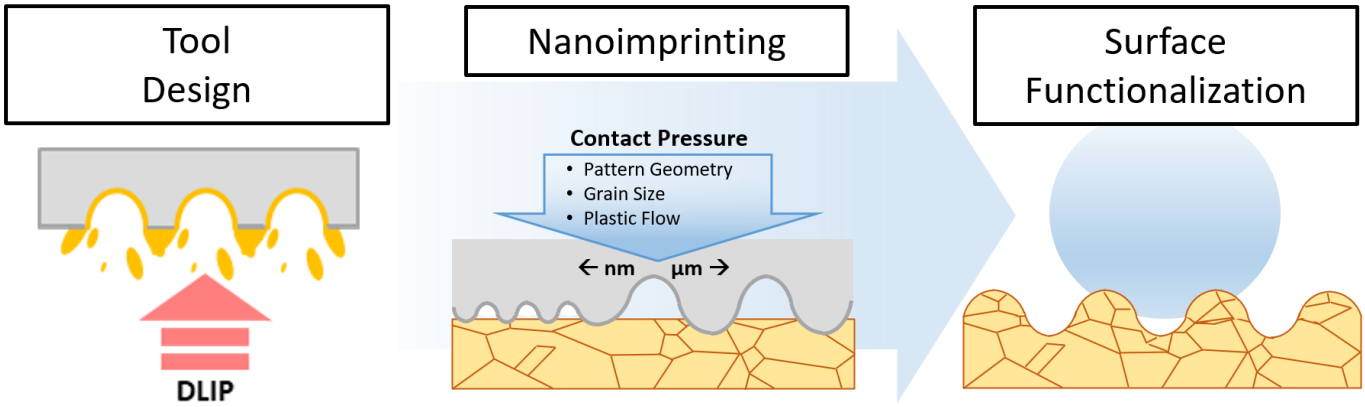

Figure 1: Schematic representation of the process and the influencing parameters (Braun et al., Appl. Surf. Sci., 2023, 10.1016/j.apsusc.2022.155786).

ARL Topic/Master Thesis:

FEM Analysis of the plastic flow characteristics and scalability of nanoimprinting in CuZn30

To upscale the nanoimprinting process for industrial applications, a detailed examination of process parameters is crucial. Finite Element Modelling (FEM) can facilitate this by allowing the tool geometry to be scaled without the need for physical prototypes or extensive experimentation. This approach offers potential advancements in predicting the behaviour of materials under imprinting conditions.

Research Questions:

- How accurately can FEM predict the plastic flow characteristics and surface changes of CuZn30?
- How well do FEM results align with experimental data? Can FEM be used to reliably predict experimental outcomes?

Tasks:

- Develop a finite element model for the nanoimprinting process
- Define parameters that limit the effectiveness of pattern transfer to the workpiece
- Identify parameters contributing to process inaccuracies