Substrate morphometry enhances the understanding of bacterial adhesion on nanostructured surfaces

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Surface topography plays a decisive role for the formation of biofilms and the behaviour of adhered microbials such as cells or bacteria. Newer studies revealed that a description of surface roughness by a root mean square (RMS) value only is a too simple model to capture the topography involved in bacterial adhesion [1]. We show that the RMS could not explain the change in the adhesive behavior of *Staphylococcus aureus* on black Si samples featuring a variable nanoroughness. However, the Minkowski functionals from integral geometry provide a comprehensive and robust characterization of complex random structures [2] that have been successfully applied to a variety of applications, including material science [3] and pattern formation [4]. Minkowski functional analysis of nanorough surfaces can reliably distinguish topographies with similar RMS values of surface roughness. Thus, shape analysis based on Minkowski functions yielded a quantitative agreement between the fraction of the surface accessible to the tethering macromolecules and the adhesion forces determined experimentally [1].

In this poster we will focus on the intuitive interpretation of the scalar and tensorial Minkowski functionals and discuss their advantage compared to the RMS. Furthermore, we will analyze the surface topography of dental ceramics and black Si by atomic force microscopy and show a way to

calculate the Minkowski measures in dependence of height, which leads to quantitative comparison of the different types of roughness.

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