Proteins sense different grain orientations in hydroxyapatite during adsorption

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Protein adsorption is the first step of biofilm formation and can therefore be highly desirable or unwanted. Characterizing protein adsorption on different types of very controlled substrates enables us to gain insight into the governing forces. In this new study, we used hydroxyapatite (HAP) pellets as a model system for tooth enamel. The pellets reach a density of > 97 % of the theoretical crystallographic density of HAP and have been produced by compacting and sintering commercially available HAP powder. They consist of micron-sized crystalline grains of different orientation. Atomic force microscopy (AFM) combined with electron backscatter diffraction (EBSD) measurements reveal the smoothness and the crystal orientation of the HAP grains on the surface of the pellets. On these surfaces, single molecule BSA adsorption experiments are performed in a microfluidic setup revealing that different grain orientations provoke different adsorption rates. These findings open a pathway to control protein adsorption.