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S E M I N A R
aus
Halbleiterphysik und Nanotechnologie

Di, 7.6.2016, 11:00 Uhr, Hörsaal für Physik

"How teeth work: X-ray insights into the micro and nano structures of human dentine"

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Dentin in teeth is a bone-like nanocomposite built of carbonated hydroxyapatite (cHAP) mineral particles, protein and water. As a structural material, it is assumed to be excellently adapted for decades of mechanical function, due to the interplay between its constituents. In this presentation I will discuss our work performed on samples of human origin, where we combine X-ray and optical characterization methods to understand the material science of this tissue. The work combines heat treatments with synchrotron X-ray diffraction and phase contrast-enhanced nano-tomography, second-harmonic generation microscopy and Raman spectroscopy and has revealed much about the water-assisted functional coupling of the mineral-protein biocomposite. For example, across roots we find a gradual reduction in the c-lattice parameter of the cHAP nano-crystals. A compressive strain of ~0.3 % is observed upon drying by mild heating (125 ºC). Dehydration results in a substantial increase in the averaged microstrain fluctuations detected from broadening in the diffraction patterns of the mineral nanoparticles. The mineral crystallite platelet length variations, on the order of 30 nm, also reveal much about how the tissue works. Our results suggest that both morphology and mineral-collagen coupling allow tooth nano-particles to sustain rather large stresses of 300 MPa, far exceeding mastication stresses.