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Nano-Engineering Biocompatibility of Implant Surfaces for Enhanced Biointegration RENAT SABIRIANOV, University of Nebraska at Omaha, ALEXANDER RUBINSTEIN, Creighton University, FEREYDOON NAMAVAR, University of Nebraska Medical Center — This paper is part of continuing efforts to explain and determine the molecular mechanisms of enhanced cell adhesion and growth that we observed for our engineered nanocrystalline coatings. We performed the first-principles quantum-mechanical calculations of the nanocrystallite of the nanostructured ZrO_2. We show that contrary to the smooth surface, the calculated charge density and the electrostatic potential vary rather significantly on the topological features of nanostructured ZrO_2 surface. Based on our findings for ZrO_2 and the concept of electrostatic and steric complementarity which have been found very successful in analysis of protein-protein interactions, we propose to extend these ideas to protein adhesion on inorganic implant. These concepts may also explain the enhanced adhesion of cells to the engineered nanostructured surfaces compared to conventional smooth surfaces.

Renat Sabirianov
University of Nebraska at Omaha

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