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Role of defects in the physiological fate of carbon nanomaterials

ALEKSANDR KAKINEN, Laboratory of Molecular Genetics, National Institute of Chemical Physics and Biophysics, Akadeemia tee 23, Tallinn 12618, Estonia, RAMAKRISHNA PODILA, JINGYI ZHU, POOJA PUNEET, Department of Physics and Astronomy and Clemson Nanomaterials Center (CNC), Clemson University, Clemson, SC 29634, ANNE KAHRU, Laboratory of Molecular Genetics, National Institute of Chemical Physics and Biophysics, Akadeemia tee 23, Tallinn 12618, Estonia, APPARAO RAO, Department of Physics and Astronomy and Clemson Nanomaterials Center (CNC), Clemson University, Clemson, SC 29634, NATIONAL INSTITUTE OF CHEMICAL PHYSICS AND BIOPHYSICS, TALINN TEAM, CLEMSON NANOMATERIALS CENTER, CLEMSON TEAM — Charged defects play an important role in not only materials properties (P. Puneet et al., Scientific Reports, 3, 3212 (2013)) but also in the determination of how materials interact at the nano-bio interface. Recently, it was shown that any physiological response, and hence the fate of carbon nanotubes (CNTs) in biological media, is dictated by the formation of protein-corona. Accordingly, we explored how defects in CNTs influence the biological interactions and protein corona formation using micro-Raman spectroscopy, electrochemistry, photoluminescence, and infrared absorption spectroscopy. Our results show that the interaction of CNTs and proteins (albumin, fibrinogen, and fetal serum) is strongly influenced by charge-transfer between defects and proteins ensuing in protein-unfolding which leads to a gain in conformational entropy.

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