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Phase-sensitive Neutron Reflectometry Studies of a Biomineralization Peptide. Ursula Perez-Salas, W. Shaw, S. Krueger, V. Silin, D. McGillivray, C. Majkrzak, N. Berk, Physiology and Biophysics, NCNR, Univ. of California Irvine, NIST, Gaithersburg, MD 20899.

A phase-sensitive neutron reflectometry (NR) method was used to study the surface orientation of the biomineralization peptide, LRAP. Naturally occurring biominerals possess an impressive array of strength, order and nanostructure, resulting directly from protein controlled-nucleation and templated mineral growth. The secondary and tertiary structures of biomineralization proteins are often implicated in these processes. However, very few techniques exist which can quantitatively characterize secondary structure of surface immobilized proteins. Phase-sensitive NR methods provide an essentially exact determination of the neutron scattering length density (SLD) profile perpendicular to the plane of the surface, limited only by sample integrity and the quality of the data.

LRAP is a 59-amino acid residue variant of the biomineralization protein, amelogenin, a protein that is found to control tooth enamel development. Peptides for the NR measurements were prepared with 7 amino acids near the C-terminus of the LRAP labeled with deuterium in order to increase their neutron SLD with respect to the non-labeled residues. The peptide was bound to a 25Å-thick C_{16}-ethylene oxide layer with a COO- group presented at the surface. The entire system was supported on planar, gold-coated substrates and measured in both a humidity chamber filled with Argon gas at ~92% humidity and under completely hydrated conditions. The phase-sensitive NR method used to determine the orientation of the LRAP peptide on this surface will be described and the resultant compositional depth profiles, derived from the SLD profiles, will be presented.