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Inelastic neutron spectroscopy on biosurfaces: a search for fundamental mechanisms of complexation

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Adsorption and surface complexation of biological molecules on inorganic materials are actively studied in such diverse fields as chemistry (geochemistry, biochemistry), biotechnology (medical implants, biosensors, tissue engineering, bioelectronics, biomimetics and artificial photosynthesis), radiation technology (radiation damage and detection), colloid chemistry, surface chemistry and physics

Inelastic neutron spectroscopy is the domain of vibrational spectroscopy on bulk materials. There are exceptions to this rule where the surface dominates the scattered signal due to huge surface to volume ratios and large scattering cross-sections from adsorbate molecules. The deposition of amino acids and carbonyl-sulphide onto oxide surfaces is a fruitful area of discovery in the field of prebiotic formation of peptides.

The deposition of amino-acids onto alumina from solution and in the presence of OCS was investigated by both inelastic neutron spectroscopy and high resolution photoemission. Studies focused on the extent of adsorption at various pH's, the character of each adsorbate (zwitterionic, basic, acidic), and the number of discrete surface sites of adsorption. Results show strong chemisorption of amino acids through an ester type bond with the alumina surface across a range of pH. Direct sorption of the amine group with alumina was observed only at pH 9. Formation of multilayers and/or peptides may also occur in conjunction with OCS absorption.