Adsorption Behavior of Fatty Acids on AlOOH Surface: From Self-assembly to Surface Nanostructuration

I. Liascukiene [a], J. Landoulsi [b], N. Aissaoui [b], J-F. Lambert [b], S. J. Asadauskas [a]

[a] Center for Physical Sciences and Tecnology, Institute of Chemistry, A. Gostauto 9, LT-01108 Vilnius, Lithuania

[b] Université Pierre et Marie Curie-Paris VI, Laboratoire de Reactivité de Surface, UMR CNRS 7197, Place Jussieu, Case 178, 75252 Paris cedex 05, France

e-mail for corresponding: irma@chi.lt

The adsorption of lipids and fats on Al surfaces has attracted much interest owing to its relevancy in the food, biomedical and fuel industries. However, the mechanism of interaction of these molecules with Al oxides/hydroxides remains not well understood. This is due to the multiplicity of interfacial process involving the substrate (oxidation, dissolution) and molecules (adsorption, self-assembly, self-organization …). In the present study, we investigate the adsorption behavior fatty acids (FA) and methyl oleate on hydroxylated Al surface and focus on the influence of molecules properties: level of unsaturation and nature of head group (carboxylic acid or ester). Polarization modulation infrared absorption reflection spectroscopy (PM-IRRAS) analyses evidenced the self-assembly of FA on the Al oxy-hydroxide surface, through the formation of coordinative bonded carboxylate species. The derivative ester exhibited a different behavior in contact with the Al surface, showing its chemical transformation through a saponification reaction. The use of an innovative mode of atomic force microscopy (AFM), revealed the existence of highly ordered nanostructures guided by the FA self-assembly (Fig. 1). The size of these nanostructures was determined with accuracy suggesting structural change of the surface rather than molecular organization of FA. The stability of the adsorbed molecules was also investigated. Degradation tests were performed in aqueous medium and by means of UV-ozone treatment, showing that FA exhibit more stability compared to methyl oleate.

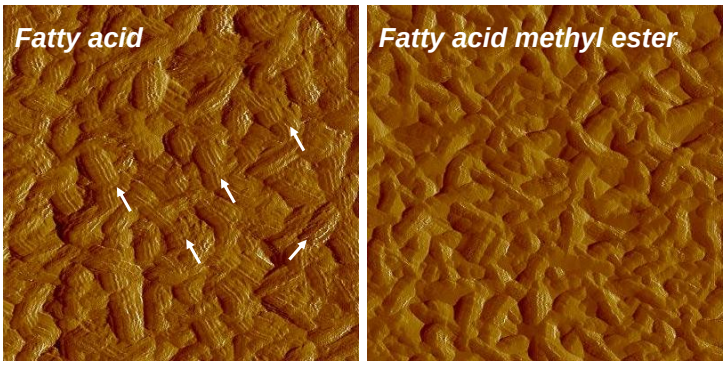

Fig. 1