A theoretical and experimental infrared study of the role of bentonite phyllosilicate in the survival of glycine and alanine amino acids on the surface of spatial bodies

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Phyllosilicates are an important subgroup of the clay minerals group which have been found on Earth and across the solar system in bodies such us Mars, Ceres or on Jupiter's moon Europa. On the search for life on these environments, clay minerals such as montmorillonite have been shown to have great ability to protect small forms of life such as bacteria against UV irradiation [1].

To understand the survival of life building blocks such as amino acids on spatial environments, a spectroscopic research has been performed by adsorbing glycine and alanine on a sample of bentonite (Wyoming), registering its spectra with a Bruker Vertex 70 FTIR spectrometer, and following the effects of processing the samples with ultraviolet radiation. Besides, a theoretical structural and spectroscopic DFT study has been carried out using the CASTEP code [2] to understand the adsorption process and to perform an accurate assignment of the vibrational modes of the samples before and after the irradiation with UV.

As shown in Figure 1, glycine and alanine are adsorbed in a lay-down configuration between the sheets of the bentonite. The corresponding IR spectra are shown in Figure 1.(b), displaying a good agreement between the predicted and the experimental spectra. Features from the products resulting from UV processing of the adsorbed amino acids are also found.

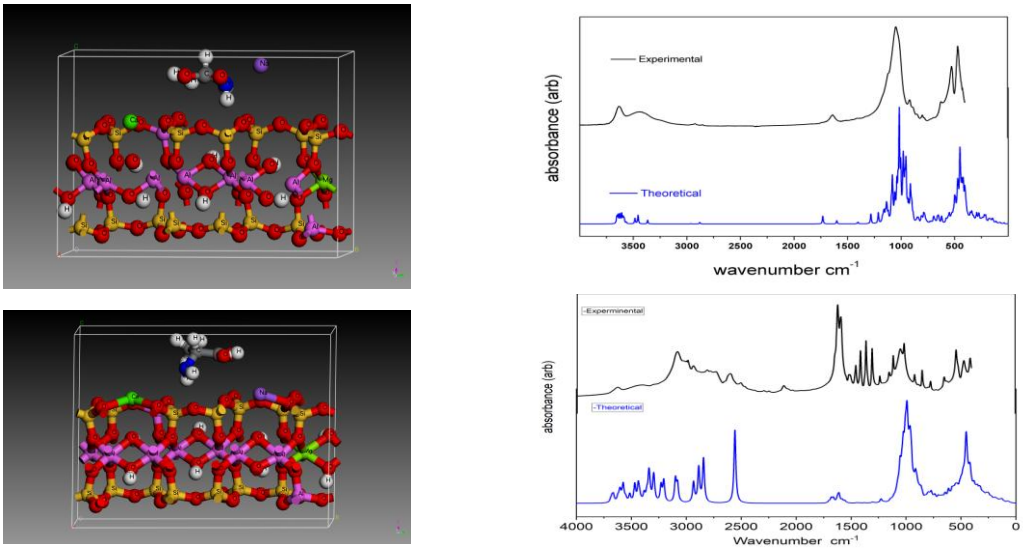

Figure 1: (a) DFT atomistic models; (b) Experimental and theoretical IR spectra of adsorbed glycine (up) and alanine (down) on bentonite.

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References

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