FFC NMR RELAXOMETRY TO UNVEIL STRUCTURAL AND FUNCTIONAL FEATURES OF CERAMIC RAW MATERIALS FROM NORTH MOROCCO

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Clayey materials are the main raw materials used for manufacturing diverse ceramic products. Given the inherent complexity of the physical, chemical and mineralogical features of clayey materials, clays from different origins have unique properties as related to their genesis and diagenesis. Morocco has several deposits of clayey materials. However, only few studies have been carried out on the quality assessment of Moroccan natural clays. Following a previous study where the chemical and mineralogical compositions of Moroccan clays were determined [1], five clay samples derived from three North-West Moroccan regions (namely Berrechid, Tiflet, and Khemisset) were analysed by means of FFC NMR relaxometry. The FFC NMR relaxometry analysis was conducted as described by Conte et al., (2022) [2]. The regression analysis of the NMRD dispersion curves was performed by means of a model-free approach, that relies on the elaboration of the inverse integral transform of the NMRD curve with the BPP function [3], avoiding the introduction of discretion elements. The analysis was complemented by applying the Monte-Carlo approach, in order to calculate the indetermination of the regression parameters and to individuate possible artifacts. The obtained results highlighted the existence of three distinct dynamic domains. Each dynamic domain can be attributed to a specific water molecular motion occurring in clay samples. These directly depend on the nature of the ^1H–^1H dipolar interactions between water molecules and clay surfaces that, in turn, are affected by the size and shape of the pores where water moves. The faster component (i.e., low τc) refers to the strongly retained water molecules and is due to the motion of intraparticle diffusion. The slower component (i.e., high τc) refers to weakly retained water molecules and is due to the motion of horizontal surface diffusion. Finally, the intermediate component can be attributed to the motion of interparticle diffusion. The absence of very slow components (i.e., $\tau c < 0.001$ μs) indicated the absence of bulk water, in accordance with the microporous structure of clayey materials.

The results of the study proved that the FFC NMR relaxometry coupled with the heuristic approach is a valuable tool to evaluate the structural and functional features of clay samples. The assessment of the main physical-chemical features of clays is a very important aspect for determining the technical performances of natural clayey materials.

References

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