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HIGHLIGHTS AND BREAKTHROUGHS

Theoretical and applied implications of the structural order of irradiated vermiculite

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Abstract: Vermiculite is a layered silicate with a complex crystalline structure, as it is characterized by the existence of a large density of defects—even in the case of the most pure vermiculite [e.g., Santa Olalla, Huelva (Spain)]. As a result of their lamellar structure, vermiculite structures present a broad diversity of behavior and are interesting from both the applied and scientific point of view. Vermiculite is used to examine interesting physical properties such as mixed-cation effects and two-dimensional magnetism. The existence of frustration and disorder is a key feature for understanding the mechanisms of spin-glass, for example. The dimensionality of magnetic interactions, which plays a central role in controlling the critical dynamics of SG systems, is still not resolved. Probably, magnetic studies on structurally ordered vermiculites will elucidate the true nature of spin-glass-like phases. One way to provide structurally ordered vermiculites might be by irradiation with ultraviolet or γ rays. These types of radiation induce structural order in vermiculites leading to materials with enhanced opto-electrical properties, which improve its utility as an electronic insulator and a thermoluminescence dosimeter for innovative dosimetry applications in a radiation-rich environment (Kaur et al. 2014, this issue). Other layered minerals irradiated with γ rays exhibit enhanced radiation shielding capacities and electronic insulating properties.

Keywords: Vermiculite, radiation, structural order, magnetism, opto-electrical properties