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Hydrothermal reactivity of Lu-saturated smectites: Part II. A short-range order study

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ABSTRACT

The short-range order of a set of Lu-saturated smectites, modified by hydrothermal treatment at 400 °C, which give rise to a new crystalline phase ($Lu_2Si_2O_7$), has been analyzed. In particular, the modifications undergone by the tetrahedral Si atoms of the lattice and the possible diffusions of O-T layer ions to other structural positions were investigated**.** Single-pulse, magic-angle-spinning nuclear magnetic resonance (MAS-NMR) measurements from the ^{1}H, ^{7}Li, ^{27}Al, and ^{29}Si nuclei, as well as two-dimensional ^{1}H-^{27}Al cross-polarization MAS-NMR experiments, have been made on both the initial and the hydrothermally treated samples. The results show that (1) the formation of the $Lu_2Si_2O_7$ takes place from Si atoms surrounded by Al tetrahedra in the samples that contain tetrahedral Al; (2) there is a diffusion of octahedral cations to the interlayer positions during the hydrothermal treatments, compatible with the X-ray diffraction data reported for this reaction; and (3) the octahedral Al migrates to the vacant tetrahedral positions that appear during the formation of the new $Lu_2Si_2O_7$ phase. A clear relationship between each sample composition and its reactivity is defined.