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Microstructural Analysis of Thermally Treated Geopolymer Incorporated with Neodymium

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The following investigation presents the thermal treatment of geopolymer based on metakaolin, with the addition of 1% and 5% of neodymium in the form Nd_2O_3, at 300˚C, 600˚C and 900˚C. Six samples were synthesized in total. Samples GT1 and GT2 containing 1% and 5% of Nd_2O_3, and they were treated at 300˚C, while the samples GT3 and GT4 also had the same percentage composition of Nd_2O_3 and were treated at 600˚C, and the samples GT5 and GT6 were treated at 900˚C with the same percentage of Nd_2O_3. Physical and chemical changes in the aluminosilicate geopolymer matrix were monitored. The incorporation of rare earths into the polymer network of aluminosilicates has been proven to disrupt the basic structure of geopolymers, however, with increased temperature, these materials show even more unusual properties. DRIFT was employed to investigate the structural properties of thermally treated geopolymers. Additionally, TEM provided further insight into the structural changes induced by thermal treatment and Nd_2O_3 doping. SEM was used to observe the effect of thermal treatment temperature (300˚C and 600˚C) on geopolymer porosity, which resulted in the appearance of large pores and cracks in the material. The UV/Vis spectra of the synthesized Nd_3^+ doped geopolymers exhibited attractive optical properties. The photoexcitation of electrons from the valence band to the conduction band in the geopolymer structure is responsible for the absorbance observed at 260 nm, while the minor peaks at slightly longer wavelengths can be linked to Nd^{3+}.

Keywords: Geopolymers, Rare earth, Neodymium, Metakaolin, DRIFT, UV/Vis