STRUCTURAL PROPERTIES OF GLAUCONITE/POLYANILINE COMPOSITES

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Compositions based on polymers and natural clay minerals (NCM) or mineral clays (MC) are relevant materials in modern technologies. Availability, low cost, chemical stability and environmental friendliness make NCM and MC, including layered phyllosilicates, important and popular components of various composite materials (CM) with synthetic, natural and electrically conductive polymers (ECP), particularly polyaniline (PAn). The synthesis and study of materials containing NCM or MC and polymers has long been one of the broadest research areas of research in materials science and technology.

Glauconite (Gl), a layered phyllosilicate mineral (2:1) consisting of one octahedral sheet sandwiched between two tetrahedral sheets (T-O-T), also belongs to NCM. The octahedral layers typically contain more Fe^{3+} than Al^{3+}, along with significant amounts of Mg^{2+} and Fe^{2+}. The difference between Gl and other NCM is its high iron content in both Fe^{2+} and Fe^{3+} states. Such features of Gl's chemical composition attract particular interest due to the potential influence of iron ions on certain physicochemical properties of composites containing Gl and PANI. As is well known, polyaniline is the most studied and widely used representative of the ECP class [1].

The synthesis of glauconite/polyaniline (Gl/PAn) samples was carried out by a one-step chemical oxidation of aniline (An) in aqueous 0.5 M sulfuric acid (H_2SO_4) at a temperature of 20±1 °C. The Gl:An weight ratios in the reaction mixture were 1:1, 2:1, 3:1, 4:1 and 5:1. A solution of ammonium persulfate oxidant was added dropwise to the reaction mixture over the course of one hour. The resulting green suspension was aged for 24 hours, then washed with distilled water until the filtrate was colorless and neutral and dried in a vacuum oven a temperature of 50 °C for 24 hours and subsequently used for characterization. The structural properties of the composites, including the morphology and state of PAn, as well as the phase composition and elemental makeup of the Gl/PAn samples, were investigated using modern techniques and instrumentation.

Analysis of X-ray diffraction (XRD) patterns, Fourier transform infrared (FTIR) spectra, and ultraviolet-visible (UV-Vis) spectra showed that the polydisperse Gl particles are coated with a layer of PAn and there is a strong interaction between the composite components due to hydrogen bond formation. The thickness of the PAn layer depends on the Gl:An ratio used in the synthesis. It was established that PAn in the composites is in the state of emeraldine salt of sulfuric acid.

The investigation of physical properties, including specific electrical conductivity, specific magnetization, microhardness and specific density of the synthesized Gl/PAn samples confirmed their composite nature. Phase analysis of the composite samples indicates that polyaniline is in an amorphous-crystalline state. he surfaces of the samples contain chemical elements originating from both Gl and PAn. As shown by the study of microhardness, the Gl particles are strongly interconnected by the polyaniline macromolecules.

Therefore, the combination of the NCM glauconite with polyaniline in various ratios can serve as a promising material for potential applications.

[1] M. Beygisangchin, A.H. Baghdadi, S.K. Kamarudin et al. Recent progress in polyaniline and its composites; Synthesis, properties, and applications, Eur. Polym. J. 2024. **210**. 112948.