

**STUDY OF THE CHEMICAL STRUCTURE OF POLYANILINE COMPOSITE
MATERIALS BY IR SPECTROSCOPY**

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ANNOTATION

This article examines the study of the chemical structure of polyaniline composite materials by IR spectroscopy.

Keywords: *chemical structure, IR spectroscopy, spectrum, composite materials, polyaniline, electrical conductivity.*

Composite systems based on electrically conductive polymers with objects that combine the properties of two classes of modern polymeric materials: electrical conductivity and the ability to directionally change geometric dimensions. Composites containing conductive polymers can be used as components of electronic, sensor, and electromechanical systems. In this work, based on IR spectroscopy data, the analysis of the chemical structure of composite systems based on a gel of crosslinked polyacrylic acid (PAA) and an electrically conductive polymer-polyaniline (PANI) is performed. PAA hydrogels were prepared by the standard method of radical copolymerization of acrylic acid with a bifunctional crosslinker. The molar ratio of acrylic acid/crosslinker was 300/1, the concentration of acrylic acid was 25% by weight. PAA/PANI composite systems were obtained by a two-stage method. A sample of PAA hydrogel equilibrium swollen in water was placed in an aqueous solution of aniline, and then in a solution of an oxidizing agent — ammonium sulfate peroxide in hydrochloric acid (0,1 mol/l). The molar ratio of aniline/oxidant was 1/1,125. It was found that the increased affinity of the basic monomer to the acidic groups of PAA leads to its concentration inside the gel, which contributes to an increase in the degree of swelling of the hydrogel from the initial 10 to 150–200 g/g, depending on the concentration of aniline in the solution surrounding the gel. When the gel with the monomer was placed into the oxidizing agent solution, the sample collapsed and became opaque — aniline polymerization proceeded in it, and PANI was not significantly formed outside the gel. The IR spectrum of the composite system is the sum of the absorption bands characteristic of both components of the composite. It can be argued that PAA in the composite system is in acid form, which is confirmed by the presence of an intense peak at 1700 cm^{-1} . The distinct absorption band at 1110-1090 cm^{-1} indicates the formation of PANI in salt form. The peaks in the range of 1550–1540 and 1500 cm^{-1} are attributed to vibrations of quinoid and benzene rings, respectively. These results indicate the formation of emeraldine salt in the composite. However, the counterion for PANI is not PAA, but hydrochloric acid. The degree of swelling of the composites is comparable to the degree of swelling of the initial PAA matrix (10 g/g). An increase in the PANI content leads to a natural decrease in the degree of swelling as a result of the formation of a rigid framework of an electrically conductive polymer.

The electrical conductivity of the obtained composites was $(1,0-5,0) \cdot 10^{-7}$ PAA matrix with the electrical conductive properties of PANI.

Based on the study of the chemical structure of PANI formed in the PAA hydrogel matrix, the factors influencing the conductivity of the composite system were established.

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