POLYMERIC NANOCOMPOSITES BASED ON POLYMETHACRYLIC ACID AND POLYANILINE

Khamar O. O., Dutka V. S., Kovalskyi Ya. P.
Ivan Franko National University of Lviv, str. Cyril and Methodius 6,
Lviv 79005, Ukraine
oleh.khamar@lnu.edu.ua

Composites containing a film-forming polymer, such as polymethacrylic acid (PMAA) and other vinyl polymers, are often used to produce a variety of sensors and biosensors, and emeraldine salts of polyaniline (PANI) and their derivatives are used as an electrically conductive component. Sensors and biosensors developed on such composites can be successfully used for the analytical determination of gases such as ammonia, hydrogen sulfide, sulfur dioxide and others, as well as amino acids and sulfur-containing compounds. The electrical conductivity of composites based on PANI and PMAA was synthesized and investigated. The obtained composites are characterized by good film-forming properties and electrical conductivity.

Physicochemical properties of the obtained composites with different composition of PMAA and PANI were studied. Thermo gravimetric experiments of PMAA and PMAA and PANI composites were performed. The activation energies of the thermal destruction process of the studied composites were found. The increase in the content of PANI leads to a sharp increase in electrical conductivity in the composite PANI-PMAA. The study of the morphology of composites shows that at 10 % of the PANI content, electrically conductive polymer chains are formed, which provide electrically conductive properties. Further increase in PANI leads to a sharp increase in the electrical conductivity of composites. The study of the dependence of the resistance of the obtained composites on temperature allowed to determine the activation energy of charge transfer (ε). Numerical values of ε indicate that the resulting composites are typical semiconductors. The obtained composites have good film-forming properties, which allows to obtain electrically conductive films on different surfaces.

Quantum chemical modeling of nanocomposites was performed by the semi-empirical method PM7 of the MOPAC2016 program and the Winmostar graphical interface. The study showed that, depending on the conformational state between PMAA and PANI macromolecules, intermolecular hydrogen bonds with different energies are formed (Fig.), which affect the physicochemical properties of composites.
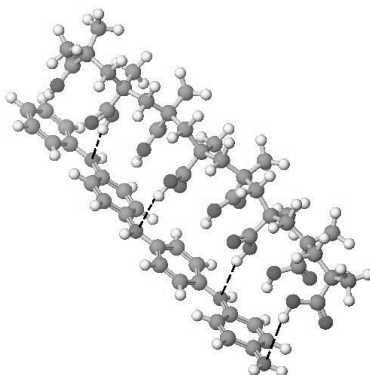

Fig. Formation of intermolecular hydrogen bonds
between PMAA and PANI macromolecules