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ВЛИЯНИЕ ЙОДИРОВАНИЯ УГЛЕРОДНЫХ НАНОДИСПЕРСНЫХ НАПОЛНИТЕЛЕЙ НА МЕХАНИЧЕСКИЕ СВОЙСТВА И ЭЛЕКТРОПРОВОДНОСТЬ КОМПОЗИТОВ НА ОСНОВЕ СОПОЛИМЕРА ЭТИЛЕНА И ВИНИЛАЦЕТАТА

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Электропроводные полимерные материалы имеют большой потенциал применения в различных отраслях промышленности, например, как электроды катодной защиты, нагревательные элементы, элементы гибкой и носимой электроники, защита от электромагнитных помех, биосенсоры, системы для доставки лекарств, и многое другое.

Цель работы — исследование влияния смесей углеродных наноструктурных наполнителей с различными факторами формы (многостенные углеродные нанотрубки (МУНТ) и графен) в исходной и галогенированной формах на прочностные характеристики и электропроводность сополимера этилена и винилацетата (СЭВА).

В рамках настоящего исследования методом вальцевания были изготовлены композиты на основе СЭВА, наполненного разными сочетаниями квазидву- и одномерных наполнителей в исходной и галогенированной формах и показано, что при сравнительно высоких концентрациях МУНТ в большей степени, по сравнению с графеном, снижают эластичность и незначительно улучшают показатели прочности. Относительное удлинение при разрыве снижается ориентировочно с 1200% до 650%, разрушающее напряжение при растяжении возрастает с 9 МПа до 11 МПа). Йодирование в небольшой степени ухудшает механические свойства, но повышает электропроводность композитов. Сравнение электрических свойств композитов, наполненных йодированным и исходными углеродными наноматериалами, показывает, что общий характер зависимости электропроводности от концентрации для исходных и йодированных форм наполнителя сохраняется и для МУНТ, и для графена, но общий уровень проводимости при модифицировании йодом возрастает для всех концентраций. Наибольший эффект повышения проводимости при введении галогенированных наполнителей, более чем на два порядка при содержании МУНТ + графен + йод 10 мас.%.

Полученные материалы могут применяться в качестве эластичных нагревательных элементов, как антистатические добавки, для получения электродных материалов для электрохимических систем преобразования и хранения энергии и в других областях.

Ключевые слова: сополимер этилена с винилацетатом, многостенные углеродные нанотрубки, графен, йод, электрическая проводимость.

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THE EFFECT OF IODIZATION OF CARBON NANODISPERSE FILLERS ON MECHANICAL PROPERTIES AND ELECTRICAL CONDUCTIVITY OF COMPOSITES BASED ON THE COPOLYMER OF ETHYLENE AND VINYL ACETATE

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Electrically conductive polymer materials have great potential for use in various industries, such as cathodic protection electrodes, heating elements, elements of flexible and wearable electronics, protection against electromagnetic interference, bio-sensors, drug delivery systems, and more.The purpose of the work is to study the effect of carbon nanostructured fillers filled with mixtures with various shape factors (multi-walled carbon nanotubes (MWCNTs) and graphene) in the initial and halogenated forms on the strength characteristics and electrical conductivity of the ethylene and vinyl acetate copolymer (SEVA).

In the framework of the present study, composites based on EVA filled with different combinations of quasi-double- and one-dimensional fillers in initial and halogenated forms were fabricated by rolling method and it was shown that at relatively high concentrations of MWCNTs to a greater extent, compared to graphene, reduce elasticity and slightly improve strength parameters. Relative tensile elongation decreases from 1200% to 650%, tensile failure stress increases from 9 MPa to 11 MPa). Iodization deteriorates mechanical properties to a small extent, but increases the electrical conductivity of the composites. Comparison of electrical properties of composites filled with iodized and initial carbon nanomaterials shows that the general character of electrical conductivity dependence on filler concentration after iodization of initial and iodized forms of filler is preserved for both MWCNTs and graphene, but the general level of conductivity at modification with iodine increases for all concentrations. The greatest effect of conductivity increase at introduction of halogenated fillers, more than on two pore-docs at is reached in the systemscontaining MWCNT + Graphene + iodine 10 wt.%.

The resulting materials can be used as elastic heating elements, as antistatic additives, to produce electrode materials for electrochemical energy conversion and storage systems and in other fields.

Keywords: ethylene copolymer with vinyl acetate, multi-walled carbon nanotubes, graphene, iodine, electrical conductivity.

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