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Synthesis, characterization and applications of conductive polymers

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Conducting polymers find wide application in fields like sensors, batteries, membranes, capacitors etc. Among all the conducting polymers, polyaniline (PANI) and polypyrrole (PPy) are widely investigated, owing to their easy synthesis process and applicability in many fields. These polymers can be synthesized using either chemical or electrochemical oxidative polymerization technique. In present work, synthesis of PANI and PPy was carried out by chemical oxidative polymerization. The effect of temperature and monomer: oxidant ratio on synthesis of PANI was investigated. Whereas, effect of type of oxidant and solvent on synthesis of PPy, was studied. Both the synthesized polymers, for which optimum value of conductivity was observed, were further characterized by XRD, SEM, FTIR, TGA and DSC. The synthesized PANI confirmed crystalline nature and fiber like morphology. The synthesized PPy was of amorphous in nature with spherical morphology. Synthesis of pure polysulfone membrane and its composite membranes with PANI and PPy was carried out using immersion precipitation phase inversion technique. The synthesized membranes were characterized by FTIR, confocal microscopy and TGA. The performance properties of synthesized membranes, such as pure water flux, permeability, hydrophilicity, pore size, porosity, flux recovery ratio, were investigated. It was observed that, addition of conducting polymers increases the hydrophilicity, pore size, anti fouling tendency of the membrane.

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Effect of external process (sterilization) on the plastic injection moulded parts

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External processes like sterilization on plastics have become an important factor in industry. Sterilization is very common process in the medical device industry to ensure the safety of the devices. Product designer needs to be cognizant of the effect of sterilization in plastic injection molded parts. An experimental method is conducted to find out the effect of the mechanical properties such as tensile strength analysis and also Creep analysis on the injection molded parts before and after sterilization (radiation). Injection molded specimen made up of PP (polypropylene) with gamma radiation of 25 kGy (kilogray) dose was considered for study. Radiation interacts with polymers in two ways: Chain scission; which results in reduced tensile strength and elongation and crosslinking; which increases tensile strength but reduces elongation. Both reactions occur simultaneously but one is usually dominant, depending upon the specific polymer and additives involved. The results of Creep analysis are used in finite element methods to solve the impact of creep between the parts under load over time. Manufacturers should be cognizant of the possible impact of radiation on mechanical properties such as tensile strength, elastic modulus, impact strength and elongation. Outcomes may influence performance and should be evaluated in advance by functional testing.

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