Effect of radiation induced crosslinking and degradation of ETFE films

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Poly(ethylene-*alt*-tetrafluoroethylene) (ETFE) has better radiation stability than its perfluorinated counterparts, it is non reactive with acids or alkalis and has a relatively high mechanical, thermal and electrical resistance. Therefore, due to its physical and chemical stability, it is an interesting material to be used as support for ion exchange membranes. However, the same chemical inertness is a barrier for its chemical modification by conventional oxidizing agents. Ionizing radiation is known to be a powerful tool to create reactive species in the bulk and surface of fluorinated polymers. The exposure of ETFE to radiation promotes degradation of its molecular structure, compromising some of its desirable properties for ion exchange membrane applications. The acetylene is a multifunctional monomer used as a crosslinking agent for fluoropolymers that enables the enhancement in mechanical and chemical properties. The purpose of this work is to study the effect of radiation in a crosslinking (acetylene), an inert (nitrogen) and an oxidizing (oxygen) atmospheres. The ETFE film with 0.125µm of thickness was put into the nylon bag and filled with acetylene, nitrogen or oxygen. Following the procedure, the samples were irradiated at 5, 10 and 20 kGy. The physical and chemical properties of the modified and pristine films were evaluated by rheological and thermal analyses (TG and DSC), X-ray diffraction (DR-X) and infrared spectroscopy (IR-ATR). By rheological analysis the storage modulus (G') indicates opposite profiles when the atmospheres (acetylene and nitrogen) are evaluated according to the absorbed dose and the samples were submitted to radiation under oxygen atmosphere it is possible to observe the degradation process with the low levels of the storage modulus. The changes in the degree of crystallinity were verified in all modified samples when compared to the pristine polymer, this behavior was confirmed by DSC analysis. By X-ray diffraction was observed a decrease in the intensity of crystalline peak.