

Spectroscopic Study of recycled poly(vinylidene fluoride)

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Poly(vinylidene fluoride), PVDF, is considered one of the most versatile and stable engineering polymer due to its physical, chemical and mechanical characteristics. Its efficient applications in the exploration, exploitation and transport of petroleum fluids are widely documented and their properties have been studied in recent decades for the improvement and engineering of new materials for increasing technological challenges. The PVDF disposal should be treated with great attention. Although considered inert, the release of fluorine and hydrogen gas, hydrogen fluoride and fluorinated free radicals have been reported when PVDF is irradiated by photons and electrons. There is a knowledge gap about PVDF degradation mechanisms when exposed in long term situations like a landfill disposal. PVDF processing residues are typically landfilled and degradation studies in landfill conditions are not reported. This work aims to investigate reprocessed PVDF samples using X-ray Photoelectron Spectroscopy (XPS) in order to understand the electronic structure and modifications between PVDF samples processed and reprocessed by extrusion. The XPS analysis was performed in longscan range (0-1300 eV) and high resolution for C1s, F1s and Cl2p core levels. The samples were commercial PVDF in three different steps in the processing chain: not processed (pellets), processed and reprocessed. By interpretation of the XPS spectra it is possible to affirm that the PVDF sample is not a homopolymer but a chlorinated copolymer. The C1s XPS spectrum shows that the non-processed sample is a precursor of the PVDF. From F1s and Cl2p spectra, it is possible to conclude that chlorine affects the binding energy of F1s spectra and fluorine affects the binding energy of Cl2p spectra, confirming the presence of groups that contain chlorine and fluorine together. The most important result is that there is no significant structural difference between processed samples. This information provides greater possibilities for PVDF reuse in different applications and extends the use of spectroscopy in studies of materials for mechanical applications.