# "Investigation of the mechanisms of surface modification in ionomers using atmospheric plasma technology"

## SUMARY

The chemical nature of the surfaces of solid substrates affects their behavior in industrial applications. Numerous techniques are known for performing a surface modification of these substrates, but in recent years research in new processes which modify the surface of the substrates without altering the general properties thereof (electric or thermal treatment) Have been proposed. One of the most interesting treatment from an industrial viewpoint is based on plasma technology, which modifies the surface properties of solids quickly and cleanly without causing any waste. In addition, such technology is easily adaptable to material manufacturing at an industrial level.

Materials of polymeric nature are of great interest from the industrial point of view, as they constantly demand new materials for special applications possessing both design versatility, density, price and ease of manufacturing properties. In this family of materials we detect ionomers, copolymers that contain ionic charges in their structure (usually lithium, sodium or magnesium). These ionomers have excellent mechanical properties with great flexibility and durability. In addition, they have good processability, ionomers can be processed by conventional methods used for thermoplastic materials (injection and extrusion). The biggest disadvantage of them for technological demands is its low adhesion, both in joints with other materials or primers, because inomers have low surface energy values. Therefore it is necessary a surface treatment prior to being used.

In this study, we have used atmospheric plasma technique to modify the surface properties of sodium ($Na^+$) ionomer sheets. The effects of this treatment on its surface are quantified by contact angle measurements, Fourier transform infrared spectroscopy with attenuated total reflexion (FTIR-ATR), scanning electron microscopy (SEM) and atomic force microscopy (AFM). At the same time, we have also determined which process parameters affect the uniformity and homogeneity of the treated surface. On the other hand, we have carried out a study of the maximum force in T peel and shear peel tests of adhesive bonds ionomer-polycarbonate.

Results show that the plasma treatment at low nozzle-substrate distance and low speed plasma application (more aggressive conditions) improve the wettability of the ionomer sheets. This is because the main plasma-acting mechanism, surface activation by insertion of polar species as seen in the FTIR-ATR assay, and the physical mechanism of micro-etching of the surface, increasing the roughness of the treated samples.

Finally, we conclude that the atmospheric plasma treatment is an interesting method from industrial and environmental point of view, because it is an easy implementation process and it doesn’t generate waste.