

The RecyClass High Density Polyethylene Technical Committee (HDPE TC) investigated the effect of SiOx plasma coating used on HDPE packaging. The test campaign was made on plasma treated HDPE bottles provided by IonKraft. Tests were carried out following the procedures described in the RecyClass Recyclability Evaluation Protocol for HDPE containers¹.

The samples consisted in natural HDPE bottles plasma coated with a thin (40 to 80 nm) SiOx layer. This coating consists of a mixture of silicon organic and silicon oxide compounds, non-reactive and transparent. This type of coating is developed to provide barrier properties for gases (O₂, CO₂, Vapor), solvents, toxic or aromatic substances as well as for corrosion purposes (acid or alkaline substances). A schematic representation can be seen in Figure 1, whilst Figure 2 represents the bottles that were tested. Similar untreated HDPE bottles were used as control material to be able to discriminate the direct impact of SiOx plasma coating.

The tests were performed at Interzero. The laboratory results showed no problems during the pre-treatment steps, where the HDPE bottles were ground, washed, subjected to a floatation test, dried and air elutriated.

Blends A.0, A.50 and A.100 were extruded into pellets without problems (Figure 3). The process was stable, without any sign of build-ups, blockage in the filters or impurities in the final visual inspection. The properties of the pellets met the suggested values.

The injection moulding from pellets was carried out to create samples for mechanical characterization, specifically for tensile testing, Charpy testing, and flexural testing. All properties of the samples met the recommended benchmarks. The colour measurements conducted on the injected plaques, as depicted in Figure 4, confirmed that there was no coloration or yellowing present in any of the plaques.

The extruded pellets were mixed with virgin material to obtain the blends B.0, B.50 and B.100 and converted into bottles (Figure 5). The virgin material was provided by IonKraft; resin INEOS Rigidex® HD5502S was used. The extrusion blow moulding process was stable, the absence of any noticeable defects or imperfections in the bottles added to the good results obtained from the top load and drop impact tests indicated that the quality of the material remained uncompromised.

¹ [Recyclability Evaluation Protocol for HDPE containers](#)

Samples were punch out from the bottles to perform tensile testing, obtaining results within the recommended benchmarks for all the blends.

On the base of these results, the HDPE Technical Committee concluded that SiOx plasma coating will not disturb the recycling process of natural, white and coloured HDPE containers. Therefore, the RecyClass Design for Recycling Guidelines for natural, white and coloured HDPE containers were updated by considering SiOx plasma coating as **fully compatible with HDPE recycling**.

About RecyClass

RecyClass is a non-profit, cross-industry initiative advancing recyclability, bringing transparency to the origin of plastic waste and establishing a harmonized approach toward recycled plastic calculation & traceability in Europe. RecyClass develops Recyclability Evaluation Protocols and scientific testing methods for innovative plastic packaging materials which serve as the base for the Design for Recycling Guidelines and the RecyClass Online Tool. RecyClass established Recyclability Certifications for plastic packaging, Recycling Process Certification and Recycled Plastics Traceability Certification for plastic products.

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Annex I

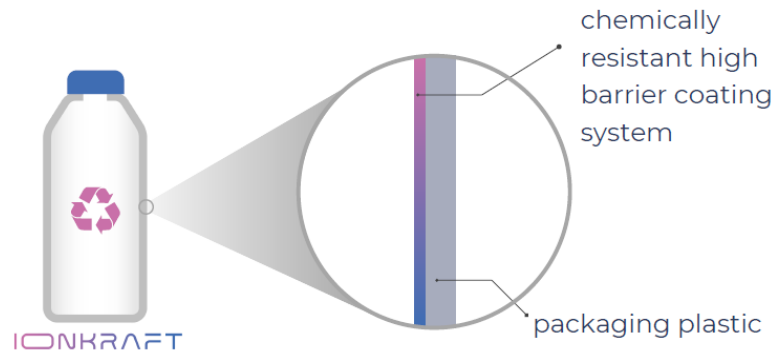


FIGURE 1. SCHEMATIC REPRESENTATION OF SIOX COATING ON AN HDPE BOTTLE.



FIGURE 2. HDPE COATED BOTTLES TESTED AT INTERZERO.



FIGURE 3. PELLETS FOR A.0, A.50 AND A.100.

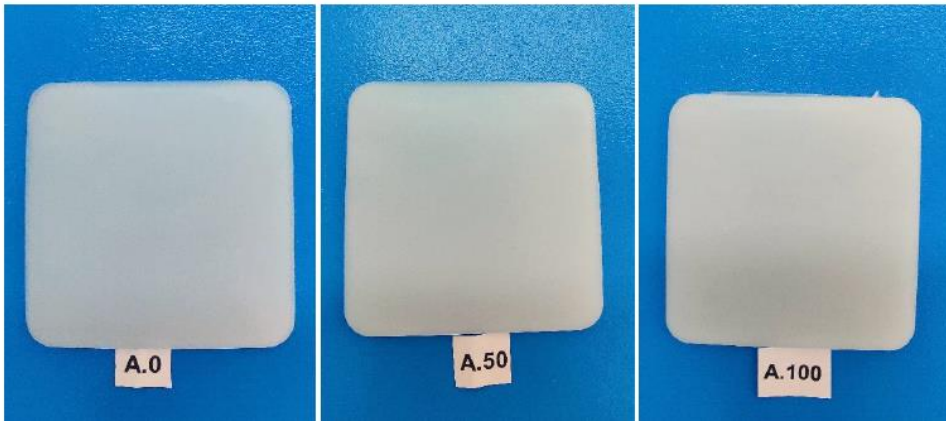


FIGURE 4. PLAQUES FOR A.0, A.50 AND A.100.



FIGURE 5. BOTTLES FOR B.0, B.50 AND B.100.