Dual-functionality multilayer coating compatible with IML for automobile applications using reactive DC magnetron sputtering

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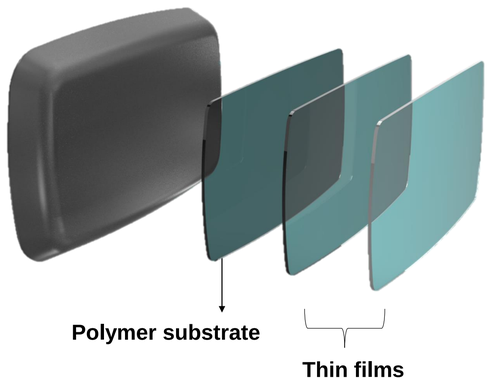
ABSTRACT

Automotive industry is a leader sector in innovation and transformation of different components, involving new techniques and technologies. Due to intrinsic characteristics of polymers, are often used in car's interior, and different properties can be achieved by using coatings, namely anti-reflective, anti-risk, anti-fingerprint or anti-fogging properties.

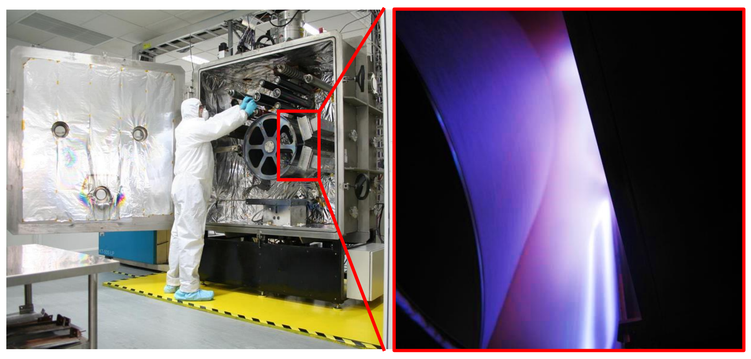
The presented work aims to reach multilayer coatings using reactive DC magnetron sputtering technology, with anti-reflective and anti-scratch properties. It is intended that the substrate, a polymer label, with coatings produced by reactive DC magnetron sputtering, is compatible and easily integrated with IML (In-Mould Labelling) technology, getting an integrated solution with added value for consumers.

DEVELOPED SOLUTION & EQUIPMENT

Multilayer approach:

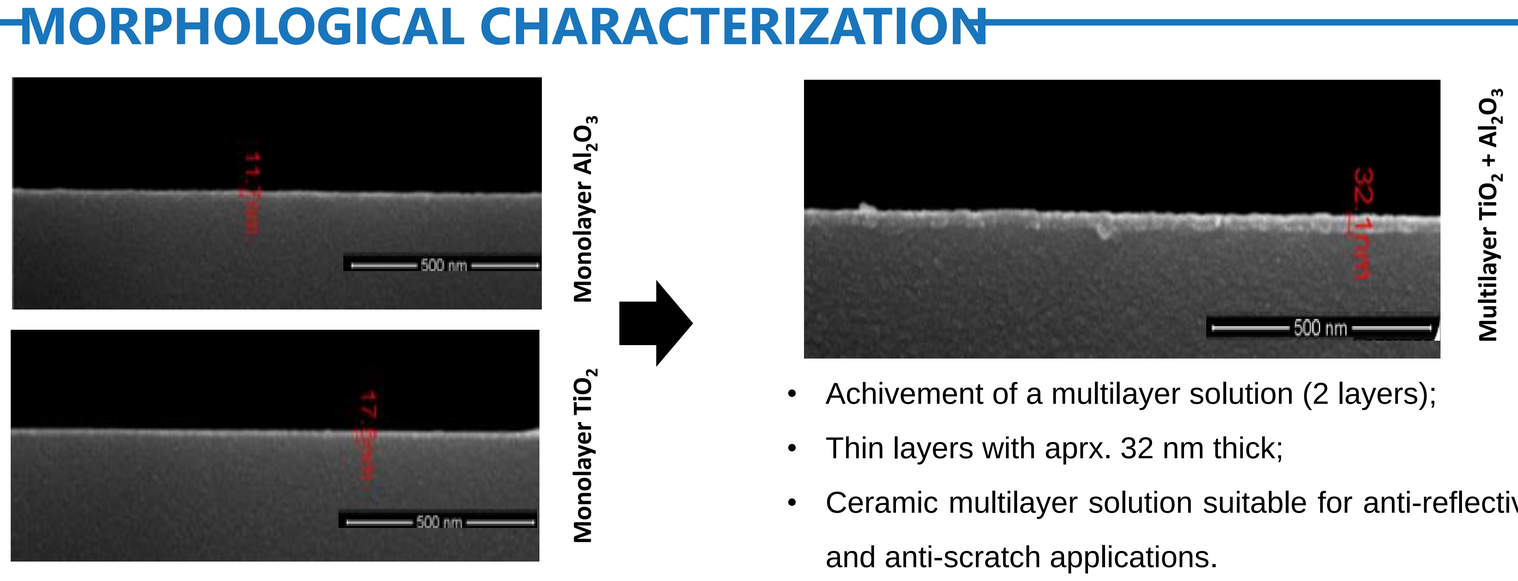


Physical vapor deposition equipment used:



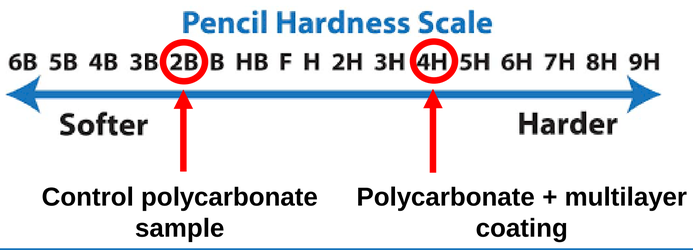
- Deposition of organic materials with reactive DC magnetron sputtering technique;
- Deposition of multilayers with materials such as SiO_2, ZrO_2, TiO_2, Al_2O_3, among others, which have been recently used for anti-reflective and anti-scratching properties.

MORPHOLOGICAL CHARACTERIZATION



- Achivement of a multilayer solution (2 layers);
- Thin layers with aprx. 32 nm thick;
- Ceramic multilayer solution suitable for anti-reflective and anti-scratch applications.

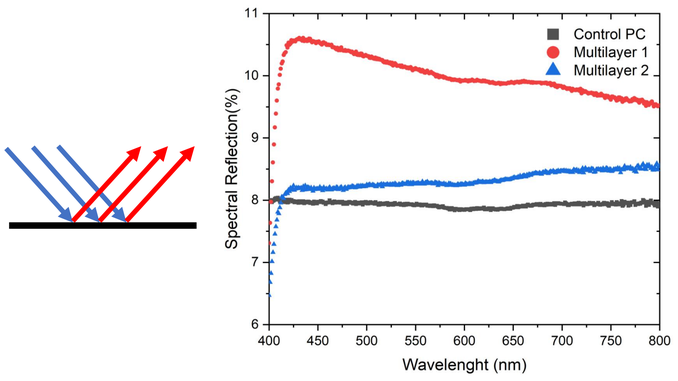
MECHANICAL RESISTANCE CHARACTERIZATION



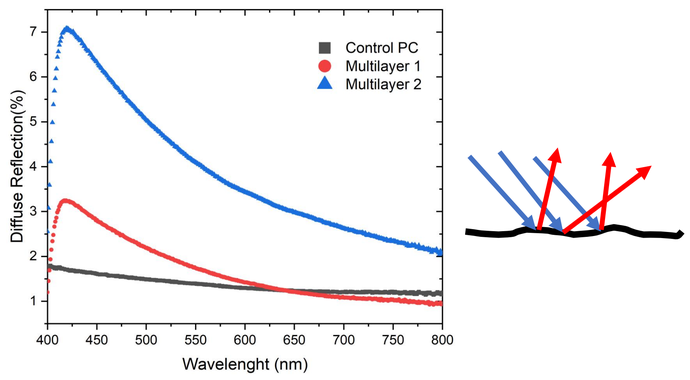
- Improvement of mechanical resistance of multilayer sample when compared to the control polycarbonate sample (tests based on ISO 15184 e ASTM D3363).

OPTICAL CHARACTERIZATION

Spectral Reflection



Diffuse Reflection



- Spectral and diffuse reflection characterization of control polycarbonate sampre, polycarbonate + multilayer 1 and polycarbonate + multilayer 2;
- Different parameters used during deposition and IML process forwards for different weights of spectral and diffuse reflection.

COMPATIBILITY WITH IML

Polycarbonate injected with a polymer label:

without a multilayer coating

with a multilayer coating

- Multilayer remained intact after IML process;
- Low diffuse reflection provides a better image definition.

FINAL REMARKS

- Sucessful deposition of organic multilayer with magnetron sputtering tecnhology;
- Nanostructured films were deposited within expected thickness. A good adhesion between organic layers and between layers and polymer substrate was obtained;
- Improvement of mechanical resistance – anti-scratch behaviour - with the presence of the multilayer;
- Thin film multilayer showed potential for anti-reflective applications; having the possibility of diverging between better spectral or diffuse reflection, taking into account the sputtering deposition and IML parameters;
- Multilayer and polycarbonate substrates proved to be compatible with IML technology, which is one of the project key points.

CONSORTIUM

CO-FUNDED

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