Innovative ion implantation technologies for cutting-edge materials : Scratch resistant glass, a first case study

Lionel Ventelon[1], Benjamine Navet*[1], Amory Jacques[1], Pierre Boulanger[1], Fabien Monteverde[2], and Denis Busardo[3]

[1]AGC – Belgium
[2]Materia-Nova – Belgium
[3]IONICS – IONICS – France

Abstract

Ion implantation technologies have been used for many years in electronic industries but never on a large scale for materials surface treatment and especially for flat glass materials. This technology consists in bombarding in a vacuum chamber the surface of a material with highly energetic ions. The ions penetrate violently into the surface of the material, then stop and lose their energy because of a cascade of collisions. The surface reorganization and the implantation of ions into the surface of the material can modify the physico-chemical properties of various materials from polymers to metals, from glass to crystals.
The judicious choice of the implanted ions allows obtaining re-alloying, amorphization or nano-restructuring of the surface, improving the material's properties or adding new functionalities. These properties are typically hardness, friction coefficient, resistance to cracking, or resistance to corrosion. Another advantage of this technology over its alternatives is its environmental friendliness (no emission, no additional heating and final product recyclability).

A new design of an ECR ion source-based micro-implanter, producing multi-charged ions (dissociation of the molecule and up to 4 positive charges) by employing high frequency microwaves, was used to obtain high productivity and large surface area treatment at affordable cost. Furthermore, the utilization of ions with different charge allows simultaneous ion implantation at different depth.
This presentation will focus on flat glass materials as a first case study. The description of certain effects of ion implantation on glass materials has been described in scientific publications since the 80's. It was for instance shown that ion implantation could improve glass scratch resistance properties on a small scale. We will demonstrate how we can reach outstanding improvements on large glass panels with good uniformity considering the final target in glass industry : 6m x 3m.

Keywords: ion implantation, properties

*Speaker