PO4036

Upscaling of a high rate microwave-PECVD process to large areas

Stefan Merli[1], Andreas Schulz[1], Matthias Walker[1], Ulrich Stroth[2], Thomas Hirth[1]

[1]IGVP, Stuttgart, Germany [2]Max-Planck-Institut für Plasmaphysik, Garching, Germany

merli@igvp.uni-stuttgart.de

Plasma deposition processes play today a fundamental role in many manufacturing steps in the industrial production. However, the upscaling of a new PECVD process from a small lab-sized system to large industrial scales is a challenging task.
In this work the upscaling of a high rate deposition process of silicon oxide (SiO_x) films using the Duo-Plasmaline was investigated. The Duo-Plasmaline is a linearly extended plasma source which is operated with microwaves at 2.45 GHz and at low pressures. Due to its high scalability in length and also as an array, it is very well suited for large area applications. The aim was to coat polycarbonate (PC) sheets with transparent, scratch resistant SiO_x layers for the use for architecture applications, where large substrate sizes of a few m² are needed.
In a first step, the deposition process was studied in an experimental reactor, called Plasmodul, on substrate sizes of 10×15 cm². Hexamethyldisiloxane (HMDSO) and O_2 were used as process gases and an array of 4 Duo-Plasmalines as the plasma source. Very high deposition rates of up to 60 µm/min = 1 µm/s could be achieved. The coatings had a high transparency, a good adhesion on the PC and a high scratch resistance.
In a second step, the process was scaled up to substrate sizes of 0,5 m² using a dynamic in-line coating reactor with a coating width of 55 cm. It consists of two side chambers for loading and unloading the substrates and a coating chamber, equipped with two Duo-Plasmalines and a linear gas feeding system which allows for a high coating homogeneity. With this system high dynamic deposition rates of up to 3 µm×m/min could be achieved. The coatings had a high optical quality, a good adhesion and a scratch resistance comparable to commercial laquers for PC.
The results on the deposition kinetics and the film properties will be presented in dependence of the process parameters for both coating systems.

Keywords
microwave plasma
SiOx
polycarbonate