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**Atmospheric pressure plasma processes: Correlations of in-line analytical investigations with surface analysis**Sandra Richter<sup>1</sup>, Nico Teuscher<sup>2</sup>, Diana Romstedt<sup>3</sup>, Andreas Heilmann<sup>2</sup><sup>1</sup>Fraunhofer-Institute for Microstructure, Halle (Saale), Germany <sup>2</sup>Fraunhofer IMWS, Halle (Saale), Germany <sup>3</sup>FILK, Freiberg, Germany

Sandra.Richter@imws.fraunhofer.de

In foil producing industries, the dielectric barrier discharge (DBD) is established to chemically modify the outermost polymer surface and improve wetting or adhesion properties. By introducing defined process gases, aerosols or precursors within a carrier gas tailor-made surface properties will be achieved. But these processes need high effort of process control to maintain good product qualities. Therefore, there is a general interest to correlate plasma parameters with the resulting surface properties and find parameters for inline process control [1, 2].

The aim of the presented investigations is to find correlations between the reactions in the gaseous phase and the resulting surface properties and evaluate the gained information as a process controlling tool. First, DBDs with various treatment atmospheres are compared and evaluated concerning their efficiency of surface activation onto low density polyethylene (LDPE). Simultaneously, optical emission spectroscopy (OES) is applied to study the reactive species in the plasma. The surface modification of the polymer surfaces is analysed in particular by the determination of the polarity by contact angle measurements. Additionally, X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM) are applied to investigate and evaluate the plasma modified surfaces.

Beside the high intensity of the N<sub>2</sub> atomic emission, the intensity of the weak O<sub>2</sub> emission peak can be used as parameters for plasma characterization and it can be correlated with surface properties like oxygen content determined by XPS and the polar component of surface tension. Therefore, the peak intensities can be used for inline monitoring of the plasma parameters and is suitable for industrial application.

[1] F. Massines, C. Sarra-Bornet, F. Fanelli, N. Naudé, N. Gherardi, *Plasma Process Polym.* 9, 1041-1073 (2012)

[2] S. Günther, N. Teuscher, A. Heilmann, R. Hänsel, H.-M. Voigt, A. Kiesow, *Adh. Sci. Technol.* 25, 857 (2011)

**Keywords**

DBD

OES

Surface Analysis