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Plasma polymerization of ethyl lactate

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By being truly biodegradable and derived from renewable resources, polylactide (PLA) has gained enormous attention as an alternative to conventional synthetic packaging materials. Nevertheless, PLA presents significant water and gas permittivity which lead to a high degradation rate of the material by hydrolysis of the ester bonds.
In order to improve the barrier properties of PLA substrate, we propose to cover it with a highly cross-linked PLA-based plasma polymer film (PPF) synthesized by Plasma Enhanced Chemical Vapor Deposition (PECVD). The control of both chemical composition and cross-linking degree would allow us to tune the gas permittivity and, as a consequence, the degradation rate of the PLA substrate.

The present work reports on the study of the influences of the experimental parameters (RF power, working pressure and precursor flow rate) on the PPF films properties using a design of experiments tool. The PPF are studied in terms of chemistry and cross-linkage by XPS, FTIR spectroscopy and Tof-SIMS measurements. In addition, *in-situ* IR spectroscopy is used to probe the plasma in order to get a better understanding on the plasma-surface interactions during the growth process. It comes out that, in our conditions, the applied power is the key parameter controlling the PPF properties. By increasing it, the C/O ratio in the coatings increases from 2.5 to 9.3. The decrease of the oxygen content when applied power is increased is correlated with the loss of O-C=O and C-O functions from 15% to 0 % and from 21% to 5 %, respectively. The *in situ* FTIR data support this observation and suggest the formation of alkynes in the plasma.

Keywords
PECVD
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Cross-linking degree
Power