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a-Si:H/a-C:H multilayer as elongation tolerant barrier coatings on PET foilsHendrik Bahre¹, Sandra Schröter¹, Marc Böke¹, Jörg Winter¹¹Institut für Experimentalphysik II, Bochum, Germany

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Since the beginning of the 20th century, polymers progressively substitute glass due to their combination of good properties in weight, transparency and toughness. Plasma processes are widely used to deposit barrier layers on polymers. The most important barrier coatings consist of silicon oxides (SiO_x), hydrogenated amorphous silicon (a-Si:H) or hydrogenated amorphous carbon (a-C:H). They show promising results in the reduction of oxygen- and water vapour transmission rate. However, these barrier layers are usually not tolerant to strain and in some cases fail at even low deformation of less than 1%. The functionality of the barrier is often dramatically decreased already at the onset of film failure. A possible solution is the employment of ultrathin layers, which may possess superelasticity. Another approach is the decoupling of functionalities with a multilayer system: Alternating sliding and barrier layers. Polymer-like, soft, amorphous hydrogenated carbon layers shall act as sliding and buffer layers and therefore avoid the propagation of cracks and retain the barrier performance of the coating. Based on a-Si:H/a-C:H multilayers, the deposition of elongation resistant barrier coatings on polymer substrates is investigated using capacitively and inductively coupled plasmas and SiH_4 and C_2H_2 as precursor gases. While the bias for the capacitively driven plasma is the self-bias due to the asymmetry of the surfaces of driven and grounded electrodes, the ICP has a substrate holder which can be driven with an arbitrary substrate bias to control the ion energy. The barrier improvement factor of the deposited coatings is measured for different strains. The crack formation is investigated during elongation with a laser scanning microscope. Supported by the German Research Foundation within the SFB-TR87.

Keywords

PET

multilayer

barrier coating

a-Si:H

a-C:H