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Silicon oxide permeation barrier coating of PET bottles and foils
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FOR PLASMA TECHNOLOGY, RUHR UNIVERSITY BOCHUM TEAM — Modern packaging materials such as polyethylene terephthalate (PET) have displaced established materials in many areas of food and beverage packaging. Plastic packing materials offer various advantages concerning production and handling. PET bottles for instance are non-breakable and lightweight compared to glass and metal containers. However, PET offers poor barrier properties against gas permeation. Therefore, the shelf life of packaged food is reduced. Permeation of gases can be reduced by depositing transparent plasma polymerized silicon oxide (SiO_x) barrier coatings. A microwave (2.45 GHz) driven low pressure plasma reactor is developed based on a modified Plasmaline antenna to treat PET foils or bottles. To increase the barrier properties of the coatings furthermore a RF substrate bias (13.56 MHz) is applied. The composition of the coatings is analyzed by means of Fourier transform infrared (FTIR) spectroscopy regarding carbon and hydrogen content. Influence of gas phase composition and substrate bias on chemical composition of the coatings is discussed. A strong relation between barrier properties and film composition is found: good oxygen barriers are observed as carbon content is reduced and films become quartz-like. Regarding oxygen permeation a barrier improvement factor (BIF) of 70 is achieved.

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