Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Permeation barrier coating and plasma sterilization of PET bottles and foils SIMON STEVES, MICHAEL DEILMANN, NIKITA BIBINOV, PETER AWAKOWICZ, INSTITUTE FOR PLASMA TECHNOLOGY, RUHR UNIVERSITY BOCHUM TEAM — Modern packaging materials such as polyethylene terephthalate (PET) offer various advantages over glass or metal containers. Beside this they only offer poor barrier properties against gas permeation. Therefore, the shelf-live of packaged food is reduced. Additionally, common sterilization methods like heat, hydrogen peroxide or peracetic acid may not be applicable due to reduced heat or chemical resistance of the plastic packaging material. For the plasma sterilization and permeation barrier coating of PET bottles and foils, a microwave driven low pressure plasma reactor is developed based on a modified Plasmaline antenna. The dependencies of important plasma parameters, such as gas mixture, process pressure, power and pulse conditions on oxygen permeation through packaging foil are investigated. A residual permeation as low as $J = 1.0 \pm 0.3 \mathrm{cm}^3\mathrm{m}^{-2}\mathrm{day}^{-1}\mathrm{bar}^{-1}$ for 60 nm thick silicon oxide (SiO_x) coated PET foils is achieved. To discuss this residual permeation, coating defects are visualized by capacitively coupled atomic oxygen plasma etching of coated substrate. A defect density of 3000 mm^{-2} is revealed responsible for permeation. For plasma sterilization, optimized plasma parameters based on fundamental research of plasma sterilization mechanisms permit short treatment times of a few seconds.

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Date submitted: 12 Jun 2009 Electronic form version 1.4