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DBD Excimer VUV source for surface treatment without direct plasma contactSiegmar Rudakowski¹, Markus Roth¹¹OSRAM GmbH, Wipperfürth, Germany

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Surface treatment with plasma always has the inherent problem of surface bombardment with accelerated charged particles. Especially treatment of sensitive surfaces like semiconductors or thin plastics does not always make plasma the first choice of tools. The inline treatment of large area substrates requires the building of large vacuum chambers.

Many efforts have been made to avoid these disadvantages, such as the use of different types of afterglow plasma, temporal or spatial, or the use of plasma types with very low sheath voltage. But most of these methods massively slow down the process. Usage of atmospheric plasma avoids the need of large vacuum chambers, but problems with direct ion impact on the surface remain.

A different approach presented here is to completely encapsulate the plasma in a quartz tube which is transparent for the Vacuum-UV radiation. A dielectric barrier discharge in xenon produces VUV radiation with photon energy of 7.2eV at very high efficiencies of 30-40% and thus very low energy consumption. The surface treatment with these excimer lamps can be made in the absence of high energetic particles in different active gases under normal pressure or even in vacuum. Depending on the atmosphere the radiation induces generation of radicals, activated atoms or e.g. ozone. Separating radiation generation and generation of radicals extends the parameter range for different processes. Together with the high photon energy this opens different applications for excimer lamps traditionally performed by low pressure plasma.

Large area surfaces can be cleaned from nearly all hydrocarbons in the presence of oxygen. The VUV radiation cracks various bonds and the activated gas saturates the fragments to volatile gaseous molecules. This process under normal pressure is used to increase the wettability of inorganics. But also organic surfaces can be activated by the same process for subsequent production steps. Other applications taking advantage of this technology are chemical transformation of special silazane lacquers and growth of SiO₂ films of high density at room temperature.

In summary, it will be shown that the excimer radiation source is an environmentally friendly alternative for a lot of processes traditionally performed with low pressure plasma or atmospheric plasma.

Keywords

VUV

Excimer

surface treatment