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Cleaning of Organic Contamination from EUV Optics Surfaces Using Hydrogen-based Plasmas

Nikola Skoro¹, Evangelos Gogolides¹

¹Institute of Microelectronics, Athens, Greece

nskoro@imel.demokritos.gr

The efficiency of optics used in extreme ultraviolet (EUV) range suffers from reflectivity degradation due to oxidation and carbon contamination of mirror surfaces [1]. Therefore, an efficient cleaning procedure should be ascertained in order to facilitate increasing number of applications of EUV tools. The removal of the carbon contamination layer from the surface has been reported in hydrogen RF plasmas and using atomic hydrogen for an in-situ contamination removal method [2]. Since the process of in-situ carbon contamination removal is already established with laser induced plasmas, we performed measurements in RF plasma with similar parameters. Gas pressures of hydrogen and hydrogen mixtures with Ar and He were similar to ones used in laser-induced plasmas in EUV tools. Plasma was ignited in a helicon-type plasma source. The first step was plasma characterization by optical emission measurements. The method of optical actinometry was used to determine hydrogen atom concentration and the degree of dissociation. The results are compared to the one obtained by pressure rise measurements. An ion flux probe was used to determine the current of H₂⁺ ions. Along with hydrogen atoms and H₂⁺ ions, UV radiation from plasma plays an important role in carbon removal. Therefore, as second step, the influence of plasma radiation on carbon layers on polymer was examined. By using windows with transparency in UV region we investigated the influence of UV radiation to the carbon layer.

References

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- [2] S. Graham et al., J. Vac. Sci. Technol. B, 20, 2393 (2002)

Keywords

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