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ANALYSIS OF THE INTENSITY OF SPECTRAL LINES FROM EXCITED STATES OF TA AND GE USED FOR SPUTTERING YIELD AMPLIFICATION OF SI

The Sputtering Yield Amplification, SYA, phenomenon discovered by S. Berg in 1996. Consists of increasing the sputtering yield value by doping the target surface with generally heavier elements; modifying the collision cascade, promoting the increase in the number of deposited atoms on the substrate. However, there are cases in which certain combinations of elements do not produce SYA, in the case of Si, there is an increase of deposition with Ta and, not a change with Ge. In DC magnetron sputtering, after the expulsion of atoms from the target, they undergo potential elastic collisions with neutral gas atoms and, even fewer inelastic collisions with energetic electrons when traveling through the gaseous phase. If the energy transferred from the collision with the particle is sufficient, it will change its state into an excited one, resulting in the emission of radiation. Study of these spectra can be achieved by Optical Emission Spectroscopy, OES. The decrease or increase of the line intensity gives an approximation of the presence of atoms deposited on the substrate, suggesting insights into the interaction between the sputter atoms inside the plasma in function to the chamber's pressure. Given the above, the following work compares with OES the intensity of the spectral lines from excited species of Ar, Ge, Si, and Ta, during the process of DC magnetron sputtering when performing SYA of Si using Ta and Ge as doping elements. The results showed an increase in the intensity of the spectral line of Si on the racetrack when using Ta, contrary to Ge where the Si intensity didn't change significantly. Simulations using the binary collision by Monte Carlo software, SIMTRA, were performed for the analysis of the spatial distribution of the redeposited atoms on the target to contrast the intensity increase results with the theoretical redeposition.

Keywords

Sputtering Yield Amplification, Si-doped, Tantalum, Germanium, Optical Emission Spectroscopy.

Reference

J. Cruz et al. " Si sputtering yield amplification: a study of the collisions cascade and species in the sputtering plasma", Journal of Physics D: Applied Physics, Vol. 54, No. 37, 2021, DOI: 10.1088/1361-6463/ac0c4e.

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