EuroSciCon

EuroSciCon Joint Event on

Laser Optics & Photonics and Atomic & Plasma Science

July 16-17, 2018
Prague, Czech Republic

Am J Compt Sci Inform Technol 2018, Volume 6
DOI: 10.21767/2349-3917-C1-003

PLASMA SURFACE INTERACTION: PASSIVATION OF SOLID SURFACES

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Plasmas are used in numerous applications as the sources of different reactive species like N, O, H, OH, and H_2O_2. Reactions between these reactive species with atoms and molecules of solids could be used for functionalization of solid surfaces. Specifically to low temperature plasmas, also the functionalization of temperature sensitive materials is possible as plasma temperature does not rise remarkably over room temperature. Reasonable gas composition and choice of plasma source allow production of set of reactive species needed for specific application. Usually the main gas in these gas mixtures is an inert gas, most frequently Ar or He, as molecular additive often small percentage of gases like N_2, O_2 or H_2 is added. In respect of industrial application, Ar is preferable buffer gas as it is remarkably cheaper than He and excited states of Ar can actively participate in the production of reactive species while quenching of these species by Ar is usually negligible. In this work RF capacitively coupled middle-pressure discharge in Ar/ N_2/ H_2 mixtures was used for functionalization of a semi-conductor GaAs surface. Fast surface oxidation of GaAs surface introduces high defect density and deteriorates device performance. One possibility to passivate GaAs surface is to form thin layer of GaN on the GaAs surface by using N_2 containing plasmas as a source of active nitrogen species. Addition of H_2 to the mixture should decrease target surface oxidation and thus enhances nitridation efficiency. Present work focused on the characterization of mid-pressure Ar/N_2/H_2 plasma used for the remote nitridation of GaAs. Input power, electron concentration, electric field strength and mean electron energy were determined on the basis of electrical measurements. Gas temperature and concentration of Ar atoms in 1s states were determined from spectral measurements. The treated GaAs samples were analysed by using XPS technique.

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