World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:19, No:08, 2025

Optimize Study and Optical Characterization of Bilayer Structures from Silicon Nitride

Authors : Beddiaf Abdelaziz

Abstract : The optical characteristics of thin films of silicon oxynitride SiO_xNy prepared by the Low-Pressure Chemical Vapor Deposition (LPCVD) technique have been studied. The films are elaborated from the SiH_2Cl_2, N_2O and NH_3 gaseous mixtures. The flows of SiH_2Cl_2 and (N_2O+NH_3) are 200 sccm and 160 sccm respectively. The deposited films have been characterized by ellipsometry, to model our silicon oxynitride SiO_xNy films. We have suggested two theoretical models (Maxwell Garnett and Bruggeman effective medium approximation (BEMA)). These models have been applied on silicon oxynitride considering the material as a heterogeneous medium formed by silicon oxide and silicon nitride. The model's validation was justified by the confrontation of theoretical spectra and those measured by ellipsometry. This result permits us to obtain the optical refractive coefficient of these films and their thickness. Ellipsometry analysis of the optical properties of the SiO_xNy films shows that the SiO_2 fraction decreases when the gaseous ratio NH_3/N_2O increases. Whereas the increase of this ratio leads to an increase of the silicon nitride Si3N4 fraction. The study also shows that the increasing gaseous ratio leads to a strong incorporation of nitrogen atoms in films. Also, the increasing of the SiO_xNy refractive coefficient until the SiO_2 value shows that this insulating material has good dielectric quality.

Keywords : ellipsometry, silicon oxynitrde, model, refractive coefficient, effective medium
Conference Title : ICCASE 2025 : International Conference on Control, Automation and Systems Engineering
Conference Location : Paris, France
Conference Dates : August 26-27, 2025