INTERFACIAL REACTION OF Cr ON GaAs LAYERS PREPARED BY MAGNETRON SPUTTERING

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The study of (III-V)(Cr,Mn) polycrystalline semi-magnetic compounds is an interesting research topic due to its application in the fabrication of magnetic sensor based in polycrystalline thin film. For thin film sensor applications the preparation of semi-magnetic thin films of GaAs:Cr on crystal and transparent substrates, by low cost non-epitaxial growth techniques, rather than epitaxial growth techniques is an opening topic to investigation. In this work, in order to analysis the Cr diffusion into GaAs layers, we prepared a GaAs layer and GaAs/Cr/GaAs multilayers varying the time of deposition of Cr interlayer for \( t_g = 5 \text{ min and 10 min} \), respectively. The results obtained from X-ray diffraction revealed that the GaAs layer deposited on Si presented a ZB-type crystalline structure with a preferential orientation along of (111) direction. However, the x-ray of GaAs/Cr/GaAs spectra show the formation of CrAs and CrGa binary phases [1]. The cross sectional SEM images evidence a well-defined thinnest layer of Cr (interlayer) between two layers of GaAs of about 70 nm thickness each. In this case, the layer of GaAs pointing to a long of (111) direction has a polycrystalline structure, and present a columnar growth mode. An elemental chemical analysis by EDS performed along the entire GaAs/Cr/GaAs layers thickness allow us concluded that the stoichiometric ratio of the Ga\(_{0.5}\)As\(_{0.5}\) binary compound changed to Ga\(_{0.39}\)As\(_{0.30}\)Cr\(_{31}\) by inclusion of Cr on it. This means that an interfacial diffusion from Cr layer to the GaAs and vice versa happened, promoting the formation of GaCr and AsCr compounds [2], which is consistent with x-ray diffraction measurements. Finally, we observed a deformation of the line shape in the Raman spectrum between LO and TO vibrational phonon modes of GaAs, possibly due to the substitution of As by Cr by inter-diffusion at the interface, generating local vibration modes (LVM) of AsCr [3].

Keywords: Magnetron Sputtering, Raman Spectroscopy, Interdiffusion

References:


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