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Effects of Nitrogen Gas on the Growth of Magnesium Doped Indium Nitride Thin Films via Sol-gen Spin Coating Method.

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We report on the growth of magnesium doped indium nitride (InN:Mg) thin films via sol-gel spin coating method followed by nitridation process. Special attention was paid to the effects of nitrogen (N_2) gas on the nitridation process. In this work, the nitridation processes were carried under ammonia with and without nitrogen ambiences. X-ray diffraction results reveal that InN:Mg thin films deposited with nitrogen ambiences show formation of hexagonal structure InN layer with (101) preferential orientation. However, it was found that InN thin film grown under ambient with N_2 gas has larger crystallite size (48.27 nm) as compared to that grown under the ambient without N_2 gas (38.10 nm). Field emission scanning electron microscopy results show that both deposited films exhibit coalesced island morphology with hexagonal like structure. Elemental composition analyses by X-rays dispersive spectroscopy reveal that sample grown under ambient with N_2 gas has lower oxygen atomic percentage and higher ratio of indium to nitrogen as compared to that grown under ambient without N_2 gas. Optical properties of the Mg doped InN thin films were investigated by means of Raman spectroscopy. Two allowed Raman modes of wurtzite InN, namely, E_2(High) and A_1(LO) modes, were clearly detected for both deposited films. Nevertheless, the film grown under the present of N_2 gas shows an additional feature corresponding to v_4 vibration of the MgN_4 tetrahedron at around 564cm^{-1}. The presence of this feature indicates that the magnesium acceptors were activated and the compensation of Mg_{In}-N (LVM) was occured. Finally, all the results suggest that present of N_2 gas during nitridation process will induce better grow of the wurtzite structure Mg-doped InN thin films.

Keywords: Doped Indium nitride, Sol-gel spin coating, Nitridation process, Growth mechanism