

Growth and characterization of single crystalline Ga-doped ZnO films by metalorganic chemical vapor deposition

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Abstract

The group-III elements, such as Al, Ga and In, are possible dopants for ZnO to improve the electric conductivity of ZnO thin film. Since Ga has lower cost than In and has higher oxidation resistance than Al, it becomes the preferred dopants for ZnO thin film for transparent conducting oxide (TCO) application. We changed the amount of Ga doping into ZnO thin films to increase the carrier concentration and decrease the electric resistivity of ZnO thin film. The Ga-doped ZnO (GZO) films have been grown on c-plane sapphire substrate by metal-organic chemical vapor (MOCVD) deposition. It was found that GZO films transparency rate can reach more than up 90%, and up to 10^{-4} Ω-cm resistivity magnitude. The results show that nitrogen rapid thermal annealing treatment under vacuum for two

minutes after grow GZO transparent conductive film. GZO crystallinity of the rapid thermal annealing process using nitrogen than do not rapid thermal annealing there is only a little difference. And Ga doping into the ZnO is about to 10^{20} cm⁻³. Annealing temperature is too high will cause a decline in resistivity. It reveals that the Ga-doped ZnO can significant improve the conductivity and increase the carrier concentration. Since the site which the Ga occupies in ZnO thin films can influence the electric behavior.

References

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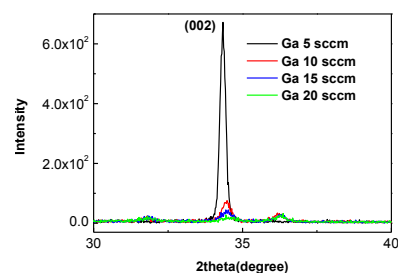


Fig.1 X-ray of GZO after RTA

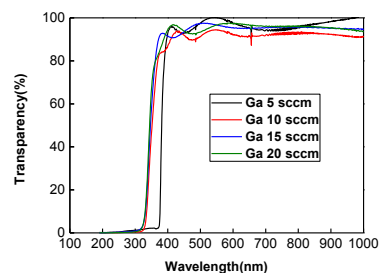


Fig. 2 Transparency rate of GZO after RTA