Abstract

- InZnO (IZO) is an amorphous TCO with interesting properties such as low electrical resistivity, high electron mobility, optical transparency in the visible and near-infrared spectrum range and low surface roughness. Due to its amorphous character, it can be deposited at Room Temperature (RT), which makes IZO an ideal material for flexible devices and a candidate for replacement of the ITO/glass combination.
- The primary source of carriers in IZO is the native defect doping via oxygen vacancies in the amorphous phase. Precise control of the oxygen gas amount during sputter deposition is required to optimize the oxygen vacancy concentration and hence the carrier density. The conductivity of the IZO films can be changed from electrically insulating to conductive by varying the oxygen concentration in the argon sputtering gas (less than 5%).
- The optimum oxygen content to maximize the conductivity is also dependant on the In to Zn ratio.
- We show the use of a feedback control of the reactive gas to stabilise the surface composition of the metallic targets by adjusting the reactive oxygen flow in response to the plasma conditions. The balance of metal and oxygen atoms is maintained at the optimum level for obtaining high deposition rates and accurate control of the film stoichiometry.
- IZO films with electrical resistivity in the $10^{-4}$Ohm.cm range and average optical transparencies of 85% were achieved.

Conclusions

The level of control shown in presented results using the optical plasma monitoring control system enables a new possibility to finely adjust the stoichiometry in amorphous thin film TCO’s such as IZO. The control is maintained at large scale, enabling an increase in efficiency for industrial scale production.