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Transparent conductive aluminium doped zinc oxide films fabricated by high power impulse magnetron sputtering near room temperature

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Transparent conductive oxides such as aluminium doped zinc oxide (AZO) are important materials that can be used in many applications, for example in solar cells or flat panel displays. For the fabrication of solar cells and also for upcoming applications, such as flexible electronics, low deposition temperatures are important. Reactive DC magnetron sputtering is a common method to fabricate AZO films on large areas. However, at low deposition temperatures the inhomogeneity of the properties is an issue. The high instantaneous power densities in reactive high power impulse magnetron sputtering (HiPIMS) could lead to improved electrical properties of the films without the need for substrate heating. In the present work, the optical, electrical and structural properties of AZO films sputtered from an alloyed Zn/Al target on glass substrates have been studied.

The influence of different sputter parameters, such as the discharge voltage and the pulse length, on the film properties has been investigated. By choosing the right parameters, homogenous films with a resistivity in the order of 10^{-4} Ωcm can be deposited near room temperature, while keeping the transmittance above 80%. These properties make the HiPIMS deposited AZO films promising candidates for use as transparent electrodes in solar cells. A model is proposed that relates the improvement of the electrical properties to the high instaneous sputtering rate in the case of HiPIMS that allows to stabilize the process in the transition mode.

Keywords
AZO
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HiPIMS