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Correlation between Carrier Transport and Orientation Evolution of Polycrystalline Transparent Conductive Al-Doped ZnO Films

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Abstract

We have been developing a deposition technology to achieve Al-doped ZnO (AZO) polycrystalline films with a well-defined (0001) orientation. We propose the use of very thin *critical layers* (CLs) made from Ga-doped ZnO (GZO) films deposited by ion plating with direct-current arc discharge, which strongly affect the orientation of AZO films deposited by direct-current magnetron sputtering. The Al₂O₃ content in the sputtering target was 0.5 wt.%. 500-, 200- and 100-nm-thick AZO films with CLs exhibited high μ_{H} values of 50.1 cm²/Vs, 40.2 cm²/Vs and 32.5 cm²/Vs, respectively, compared with those of CL-free AZO films. The presence of CLs with a preferential *c*-axis orientation as interfaces between AZO films and glass substrates plays a critical role in producing AZO films having a textured polycrystalline structure with a well-defined (0001) orientation.

Keywords: Carrier transport; Transparent conducting oxide; X-ray diffraction; Al-doped ZnO; Ga-doped ZnO; Magnetron sputtering; Ion plating

1. Introduction

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