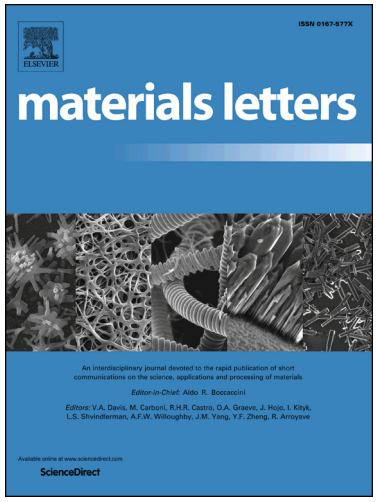

Tailoring nucleation process to gain highly oriented ZnO thin film with excellent UV luminescent and electrical performances

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Tailoring nucleation process to gain highly oriented ZnO thin film with excellent UV luminescent and electrical performances

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ABSTRACT

We present a novel approach for tuning orientation in ALD deposited ZnO nanofilm by inserting interfacial buffer layer (IBL) at interface between film and substrate, which **is found to induce** strong orientation and significant improvement in crystalline quality **by largely decreasing grain boundary (GB) area through tailoring** nucleation process. As a result, the UV emission in ZnO film with IBL is enhanced by over an order of magnitude due to the reduction of surface quenching at GB. Meanwhile, the decrease of electron scattering at GB also helps improve the electrical mobility of the film, leading to great reduction in resistivity.

KEYWORDS: ALD; Orientation; Interfacial buffer layer; Nucleation; Luminescence; Electrical properties.

1. INTRODUCTION

When scaling down to nanoscale, the ultra-small component size and soaring interface-to-volume ratio in devices demand ultra-precise control over interface roughness and uniformity to the extent that conventional methods could hardly provide. Besides, a low deposition temperature is also needed to prevent inter-diffusion through interface and to fabricate polymer-based devices. Atomic layer deposition (ALD) technique, with its atomic scale control, large-area conformality and low deposition temperature,[1,2] is able to meet all these requirements, which has emerged as a powerful tool in constructing nanomaterials. **Recently, many research efforts have been focused on achieving high quality ZnO nanofilms with simultaneously excellent electrical and optical performances by ALD for their potential applications in solar cell, lasing and LED.[3–5]**

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