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Substrate-effect on Structural and Orientational properties of ZnO Thin Film-systems Grown by Pulsed Laser Deposition

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Ever since the discovery of GaN-based blue LED systems, renewed interests have sprouded around ZnO for similar applications. The arrival of blue LED has in turn facilitated the commercial availibility of white light LED. Then ZnO, a widebandgab and inexpensive semiconductor, has huge potential to catalyse a small energy-saving revolution in terms of making low-cost acquisition, highly efficient and long-lasting white LED systems possible. Another advantage of ZnO over GaN-systems is the ease with which the electrical properties can be alterned by varying growth parameters (e.g. oxygen partial pressure). Another advantage of ZnO is its high exciton binding energy (60 meV vs GaN 25 meV) which can enable stable blue/UV-lasers at even elevated temperatures.

Two major barrieres are standing in the way: p-doping to make the necessary pn-junction possible (not touched) and secondly improving the crystalline quality of the grown ZnO thin films for better electrical properties.

Structural x-ray diffraction characterization of Pulsed Laser Depositioned ZnO thin films on sapphire (0001), MgO (001) and YSZ (001) has been carried out with supportive X-ray reflective measurements and atomic force microscopy. Pole figures obtained from x-ray diffraction give an insight on the variation of misalignment angle (deviation from the ZnO c-orientation texture) on the different substrates. Furthermore, structural phase stability dependence on the cubic or hexagonal nature of substrate and level of cubic Mg doping are investigated.

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