

## Mn掺杂对ZnO薄膜结构和光学性质的影响

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摘要 利用脉冲激光淀积的方法在Si衬底上生长出了c轴高度取向的ZnO和Zn<sub>0.9</sub>Mn<sub>0.1</sub>O薄膜.

光致发光结果显示了Mn的掺杂引起了薄膜的带边发射蓝移, 强度减弱, 紫光发射几乎消失, 但绿光发射增强.

利用X射线衍射,

X射线吸收精细结构和X射线光电子能谱等实验技术对Mn掺杂的ZnO薄膜的结构及其对光学性质影响进行了研究.

结果表明: Mn掺入到ZnO薄膜中形成了Zn<sub>0.9</sub>Mn<sub>0.1</sub>O合金薄膜, Mn以+2价的价态存在,

这就导致了掺Mn以后的薄膜带隙变大, 在发光谱中表现为带边发射的蓝移.

同时由于掺入的Mn与薄膜中的填隙Zn反应, 导致薄膜的结晶性变差, 薄膜中的填隙Zn减少, O空位增多,

引起带边发射和紫光发射减弱, 绿光发射增强.

关键词 [ZnO](#) [脉冲激光淀积](#) [XAFS](#) [XPS](#) [光致发光](#)

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## Influence of Mn-doping on the Structure and Optical Properties of ZnO Thin Film

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**Abstract** Highly c-axis oriented ZnO and Zn<sub>0.9</sub>Mn<sub>0.1</sub>O thin films were fabricated on Si substrates by pulsed laser deposition. Photoluminescence results show that Mn atoms doping induces the blue-shift of UV emission. At the same time, the intensity of UV emission decreases, while green emission increases. X-ray diffraction, X-ray absorption fine structure and X-ray photoelectron spectroscopy were employed to characterize the influence of Mn-doping on properties of ZnO thin films. The results indicate that Zn<sub>0.9</sub>Mn<sub>0.1</sub>O alloy forms after Mn doping in ZnO. Mn atoms enter into the ZnO crystal lattice and substitute Zn atoms with Mn<sup>2+</sup> state. As a result, the band gap of Zn<sub>0.9</sub>Mn<sub>0.1</sub>O increases, which is associated with the UV emission blue-shift. Furthermore, the reaction between the doped Mn and interstitial Zinc atoms(Zn<sub>i</sub>) prompts the decay of samples' crystallinity. Thus, interstitial Zinc atoms(Zn<sub>i</sub>) decrease and the oxygen vacancy (V<sub>O</sub>) increases, showing the intensity weakening of the UV and violet emission, and the increasing of green emission of the film samples.

**Key words** [inc oxide](#) [pulsed laser deposition](#) [X-ray absorption fine structure](#) [X-ray photoelectron spectroscopy](#) [photoluminescence](#)

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