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器件制备及器件物理

分子束外延生长的极性与非极性BeZnO薄膜的比较研究

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摘要： 采用分子束外延设备在不同晶面蓝宝石衬底上(*c*面,*a*面,*r*面)生长BeZnO薄膜。使用复合缓冲层生长得到了高质量的BeZnO薄膜,X射线衍射半高宽达到600 arcsec。在*c*面与*a*面蓝宝石衬底上生长得到了极性BeZnO薄膜,在*r*面蓝宝石上生长得到了非极性BeZnO薄膜。共振拉曼光谱测试结果表明薄膜中的Be含量在同一水平。相对于*c*面与*a*面蓝宝石上的极性BeZnO薄膜,生长在*r*面蓝宝石衬底上的非极性BeZnO薄膜具有较大的表面粗糙度以及较大的半高宽,但是其光致发光谱中的紫外发光峰远远强于极性BeZnO薄膜,并且黄绿光发光峰弱于极性BeZnO薄膜。

关键词： BeZnO 蓝宝石 晶体取向 分子束外延 光致发光

Comparative Study of Polar and Non-polar BeZnO Films Grown by Plasma-assisted Molecular Beam Epitaxy

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Abstract: BeZnO films were grown on different crystallographic planes (*c*-, *a*- and *r*-planes) of sapphire substrates using plasma-assisted molecular beam epitaxy (P-MBE). High quality BeZnO films were achieved using a multi-layer buffer design with full widths at half maximum (FWHMs) of rocking curves up to 600 arcsec. Polar BeZnO films were obtained on the *a*- and *c*-plane sapphire substrates, while the nonpolar ones were obtained on the *r*-plane sapphire substrate. The Raman spectroscopy confirmed the Be dopants in the ZnO were at the same level in three samples. The BeZnO sample grown on the *r*-sapphire substrate were found to have largest grains and higher FWHM, while the ones grown on *a*- and *c*-sapphire subatrates had the similar fine grains and lower FWHM. However, the photoluminescence (PL) spectra indicated the non-polar BeZnO sample had significantly stronger ultraviolet emission and weaker green emission than polar samples.

Keywords: BeZnO sapphire crystal orientation molecular beam epitaxy photoluminescence
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