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器件制备技术及器件物理

Cr/Cu/Al/Cr薄膜电极的防氧化性能

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摘要： 采用Al作为Cu导电层的主要防氧化保护层,在普通浮法玻璃上利用磁控溅射和湿法刻蚀技术制备Cr/Cu/Al/Cr复合薄膜及其电极,研究不同的热处理温度对复合薄膜及其电极的结构、表面形貌和导电性能的影响。由于有Al层作为保护层,在热处理过程中,Al先与穿过Cr保护层的氧进行反应,从而可以更有效地保护Cu膜层在较高的温度下不被氧化,所制备的薄膜在经过600 ℃的热处理之后仍然具有较好的导电性能。而对于Cr/Cu/Al/Cr电极,侧面裸露的金属层在热处理过程中的氧化是其导电性能逐渐下降的主要原因,退火温度超过500 ℃之后,电极侧面裸露部分的氧化范围不断往电极的中间扩散,导致了薄膜电极导电性能显著恶化。虽然如此,Cr/Cu/Al/Cr薄膜电极在430 ℃附近仍然具有较好的导电性能,电阻率为7.3×10^{-8} Ω·m,符合FED薄膜电极的要求。以此薄膜电极构建FED显示屏,通过发光亮度均匀性的测试验证了Cr/Cu/Al/Cr电极的抗氧化性。

关键词： Cr/Cu/Al/Cr薄膜 薄膜电极 表面形貌 防氧化性能

Oxidation-Resistant of Cr/Cu/Al/Cr Thin Film Electrodes

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Abstract: Novel Cr/Cu/Al/Cr thin film electrodes were prepared by DC magnetron sputtering and wet etching technology, in which Al thin film was used as the protective layer for Cu layer. The change of the crystal structure, surface morphology and electric resistivity of the thin films and electrodes before and after heat treatment were studied. The Al layer played a key role as an oxygen diffusion barrier layer, for its protection, the Cr/Cu/Al/Cr thin film still had good thermal stability when the heat treatment was below 600 ℃.Meanwhile, the oxidation diffusion from the lateral edge of the electrodes as the temperature increased caused the decrease of the conduction of the electrodes. The electric resistivity was increasing obviously after 500 ℃ heat treatment, and the oxidation region was expanded from the edge to the surface of the electrode. Nonetheless, the thin film electrode fulfilled the requirements of field emission device for its stable resistance when post annealing tempera-ture was 430 ℃, which was 7.2×10^{-8} Ω·m. Based on the new electrode, the FED device was fabricated for verifying its oxidation resistance.

Keywords: Cr/Cu/Al/Cr thin film thin film electrode microstructure oxidation resistant

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参考文献:

[1] 林志贤, 郭太良. 场致发射显示器研究与进展 [J]. 光电子技术, 2006, 26(1):1-5. [2] 靳孝峰,赵锋, 李玉魁, 等,高真空场发射三极显示器的制作 [J]. 液晶与显示, 2009, 24(5):661-665. [3] 陈建林, 郭太良. 场致发射平板显示器 (FED)的封接工艺 [J]. 真空, 2002, 30(3):286-288. [4] 李玉魁,郭艳清,朱长纯. 三极结构场致发射显示器件的制作 [J]. 液晶与显示, 2006, 21(3):232-235. [5] O'Neill J,Vossen J L. Cr-Cu and Cr-Cu-Cr thin film metallization [J]. *J. Vac. Sci. Technol,* 1973, 10:533-538. [6] Yuan J L, Weng W X, Lin Z L, *et al.*Study of oxidation process of Cr/Cu/Cr thin film electrodes [J]. *J. Phys. and Chem. of Solids,* 2009, 70(12):1496-1500. [7] Zlatanovic D, Davinic G.Influence of heat-treatment temperature and aluminum thickness on hillocks formation in thin aluminum films [J]. *Vacuum,* 1990,40:157-159. [8] Kawamura M,Inami Y, Abe Y, *et al.* Thermally stable Ag thin films modified with very thin Al oxide layers [J]. *Jap. J. Appl. Phys.,* 2008,47(12):8917-8920. [9] Sugawara K, Minamide Y, Kawamura M, *et al.*Agglomeration behavior of Ag films suppressed by alloying with some elements [J].*Vacuum,* 2009,83:610-613. [10] Cekada M, Panjan P, Dolinsek J, *et al.* Diffusion during annealing of Al/Cu/Fe thin films [J]. *Thin Solid Films,* 2007, 515(18):7135-7139. [11] Koike J, Wada M. Self-forming diffusion barrier layer in Cu-Mn alloy metallization [J]. *Appl. Phys. Lett.,* 2005, 87:041911(1-3). [12] Reddy A S, Uthanna S, Reddy P. Properties of dc magnetron sputtered Cu_2O films prepared at different sputtering pressures [J]. *Appl. Surf. Sci.,* 2007,253:5287-5292. [13] Meier A A, Levinzon D I. Application of the four-probe method for measuring the resistivity of nonuniform semiconductor materials [J]. *Measurement Techniques,*2005,8(5):427-429. [14] 郭太良,林志贤,吴新坤, 等. 新型可印刷FED场致发射显示器的研制 [J]. 中国有色金属学报, 2004,14(1):404-408.

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1. 王超;杨小天;唐魏;赵春雷;杨佳;高晓红;李香萍;高忠民;杜国同.不同衬底上氧化锌薄膜的金属有机化学气相沉积方法生长[J]. 液晶与显示, 2009,24(5): 666-669