研究論文

パルス電析法による Cu-Mo 合金薄膜に及ぼす浴温変化の影響

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Effect of Bath Temperature on Film Properties of Copper-Molybdenum Alloy Films Plated by Pulse Electrodepositing Method

by

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Abstract

A copper-molybdenum alloy films have been investigated as one of the most promising condidates for heat irradiation materials with low thermal expansion coefficient and high thermal conductivity. Bath temperature effected Mo content and film structure. The deposition rate decreased with increasing bath temperature from 2.0 ℃ to 30 ℃ and increased with increasing from 30 ℃ to 60 ℃. On the other hand, Mo content of the films increased with increasing bath temperature from 2.0 ℃ to 30 ℃, maximum value of 18.3 at% at 30 ℃ and decreased with increasing from 30 ℃ to 60 ℃. The deposition rate and Mo content showed opposite dependence for bath temperature. In the case of baths without sodium molybdate, the deposition rate showed constant value and was independent of bath temperature. From results of relationship between Cu (111) peak position, interplanar spacing, and Mo content in the film, the Cu-Mo alloy films had two region, crystallized region and amorphous region. The copper-molybdenum alloy films plated from bath temperature at 2.0 ℃ were composed of Cu-rich crystallized micro-grain and Cu-rich amorphous region. The alloy films plated at 20 ℃ were composed of Mo-rich micro-grains and Cu-rich amorphous region. At 30 ℃, the films composed of Cu-rich micro-grain and Mo-rich amorphous region. At 40 ℃, the films composed of Cu-rich large crystallized grains and Mo-rich amorphous region. At 50 ℃, grain size was a little smaller than that at 40 ℃, and Mo-medium amorphous region. At 60 ℃ grain size was more smaller than that at 50 ℃, and Cu-rich amorphous region.

Keywords: Cu-Mo, Alloy film, Pulse plating, Bath temperature

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1. 緒言

電子機器の高性能化，携帯化に伴い，電子部品が高密度に実装されるため，放熱の重要性は高まっている．この問題の解決には，半導体チップとそれに使用される放熱材料の熱膨張係数と熱膨張率が近いことが求められる．そのため，その特性を持つ合金を作製することが解決策の一つとなる．現在, Ni-Mo 合金[1)-6)]や Zn-Mo 合金[7)-8)]，Co-Mo[9)-10)]，Fe-Mo[11)]合金等の報告がある．その中でも Cu-Mo 合金は熱伝導性の優れる Cu と低熱膨張係数の Mo からなる材料として有効である．また，放熱材料等の材料として報告がある[12)-21)]．しかし，最適条件は不明確であり，調査する必要がある．我々は Cu-Mo 合金の作製を検討してきた[22)-25)]中で，