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論文 / 著書情報 Article / Book Information

題目(和文)	導電性材料のマイクロ接合における固相反応による組織形成挙動		
Title(English)	Microstructure evolution due to solid-state reaction at micro-bonding of conductor materials		
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Author(English)			
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 種別(和文)	論文要旨		
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論 文 要 旨

THESIS SUMMARY

専攻:	材料工学更改	甫ひ	申請学位(専攻分野): 博士 (工学)
Department of	初州工于子父	守久	Academic Degree Requested Doctor of
学生氏名:	Minho O		指導教員(主): 梶原 正憲
Student's Name			Academic Advisor(main)
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要旨(英文800語程度)

Thesis Summary (approx.800 English Words)

Electronic equipments are widely used in computers, automobiles, consumer electrical applications, and so on. At the interconnection of components in the electronic equipment, intermetallic compounds may be formed under usual energization conditions. Owing to the compound formation, fine voids can be produced inside the component and/or the compound. In the case of the automobile, the reliability of the electronic equipment is essentially important for safety of the passenger. The compound-and-void formation deteriorates mechanical and electrical properties of the interconnection and thus causes serious accidents of the automobile. In order to prevent the serious accident, the compound-and-void formation should be suppressed by appropriate artifices. For the establishment of such artifices, information on kinetics of the compound-and-void formation at the interconnection between dissimilar metals is experimentally and theoretically investigated in the present study.

In Chapter 1 "General Introduction", the background of the whole investigation is explained. On the basis of the background, the objectives of the present thesis are presented. In Chapter 2 "Reactive Diffusion in the Cu/Al System", the kinetics of reactive diffusion in the Cu/Al system was experimentally observed at temperatures of 693-753 K using Al/Cu/Al diffusion couples prepared by a diffusion bonding technique. During annealing, all the five stable compounds are formed at the original interface in the diffusion couple. The growth of the compounds is predominantly controlled by volume diffusion. However, interface reaction partially contributes to the layer growth of the γ_1 phase. In Chapter 3 "Reactive Diffusion in the Au/Al System", the kinetics of reactive diffusion in the Au/Al system was experimentally observed at temperatures of 623-723 K using Al/Au/Al diffusion couples prepared by a diffusion bonding technique. At the original interface in the annealed diffusion couple, Au₈Al₃, AuAl and AuAl₂ were observed, but Au₄Al and Au₂Al were not recognized clearly. Boundary diffusion predominantly controls the growth of the compounds. In early stages at 623 K, however, interface reaction governs the compound growth. In Chapter 4 "Reactive Diffusion in the Ag/Al System", the kinetics of reactive diffusion in the Ag/Al system was experimentally observed at temperatures of 688-743 K using Al/Ag/Al diffusion couples prepared by a diffusion bonding technique. Owing to annealing at each temperature, all the stable compounds are formed at the original interface in the diffusion couple. The growth of the compounds is controlled by volume diffusion at 723-743 K. As the annealing temperature decreases at 688-713 K, however, interface reaction gradually contributes to the compound growth. In Chapter 5 "Microstructure Evolution of Intermediate Phases in the Ag/Al System", the microstructure evolution during reactive diffusion in the Ag/Al system was experimentally examined using an Al/Ag/Al diffusion couple annealed at 703 K in Chapter 4. The microstructure of the annealed diffusion couple was observed by high-resolution transmission electron microscopy (HRTEM). The HRTEM observation indicates that a new intermediate phase is formed at the original interface in the diffusion couple during annealing at 703 K. In Chapter 6 "Reactive Diffusion in the Co/Sn System", the kinetics of reactive diffusion in the Co/Sn system was experimentally observed at temperatures of 433-473 K using Sn/Co/Sn diffusion couples prepared by a diffusion bonding technique. At the original interface in the annealed diffusion couple, only CoSn₃ was observed, but Co₃Sn₂, CoSn and CoSn₂ were not recognized clearly. The growth of CoSn₃ is controlled predominantly by volume diffusion and partially by interface reaction. In Chapter 7 "Reactive Diffusion in Microbump Metallic Systems", the kinetics of reactive diffusion in the Cu/(Sn-Cu) and Co/(Sn-Cu) systems was experimentally observed using Cu/(Sn-0.7Cu) and Co/(Sn-0.7Cu) diffusion couples prepared by a soldering technique. The observations in this chapter are not so dissimilar to those obtained under the solid-sate bonding conditions for the Cu/Sn and Co/Sn systems. In Chapter 8 "Analysis of Kinetics for Kirkendall Effect in Binary Metallic Systems", the kinetics of void formation during reactive diffusion in the Cu/Sn and Ni/W systems was experimentally observed using Cu/Sn and Ni/W/Ni diffusion couples at 473 K and 1123-1173 K, respectively. The observations were theoretically analyzed using a diffusion model for Kirkendall effect. The analyses quantitatively reproduce the observations. In Chapter 9 "General Conclusions", the general conclusions of all the results are summarized.

備考:論文要旨は、和文 2000 字と英文 300 語を1部ずつ提出するか、もしくは英文 800 語を1部提出してください。 Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).