論文 / 著書情報
Article / Book Information

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種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	材料工学専攻 専攻	申請学位（専攻分野）： Academic Degree Requested	博士 (工学) Doctor of
学生氏名： Student's Name	Minho O	指導教員（主）： Academic Advisor(main)	梶原 正憲
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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 is necessary. To obtain this information, the 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, Au_8Al_3, AuAl and $AuAl_2$ were observed, but Au_4Al and Au_2Al 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 $CoSn_3$ was observed, but Co_3Sn_2, CoSn and $CoSn_2$ were not recognized clearly. The growth of $CoSn_3$ 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 1copy of 800 Words (English).