Foils of beta-brass are quenched from various temperatures ranging from 500° to 800° into brine bath kept at −5°C and are examined by transmission electron microscopy. It is revealed that the defects observed in beta-brass distibute with a network and consist of dislocation loops and zigzag dislocations. These defects are considered to be related to the order-disorder transition via vacancy mechanisms. Monte Carlo simulation is performed to examine behaviour of vacancies during ordering. This result shows that almost all vacancies accumulate around antiphase domain boundaries (APB).

3. Effect of Helium and Hydrogen Atoms on the Formation of Voids in Quenched Aluminium

Yumi MORISHITA

Dilute aluminium alloys (Al-Ge, Al-Cu, Al-Ag) and 5-nine aluminium have been quenched in vacuum, helium or hydrogen atmosphere, and the formation of the secondary defects has been examined with an electron microscope. It has been made clear that helium atoms as well as hydrogen ones affect the formation of voids and the promotive effect of helium atoms is smaller than that of hydrogen ones. Using a set of rate equations, the promotive effect of both atoms has been discussed from the differences in solubility, migration energy and binding energy between a vacancy and a void containing a helium or hydrogen atom. It is concluded that the difference may be mainly caused by binding energy. The value of binding energy for a small void formed in helium atmosphere is inferred.

4. Studies of Random Structure by Positron Annihilation

Takashi MIHARA

The structural relaxation in the amorphous $Fe_{40}Ni_{40}P_{14}B_6$ alloy and the defects in electron irradiated germanium have been studied with positron annihilations as a microscopic probe in con-

densed matters. A positron has a unique character that the wave function is localized in a defect such as excess free volumes (a liquid-like structure) of as-quenched amorphous alloys or in vacancy-type defects in semiconductors. Therefore, we can obtain the information of the observation of γ-ray emitted from the annihilating positron-electron pair. The outline is as follows:

The Doppler broadened lineshape of 511 keV γ-ray emitted from annihilating positron-electron pairs, the positron lifetime and electrical resistivity of the amorphous $Fe_{40}Ni_{40}P_{14}B_6$ alloy have been measured in the temperature range between 0°C and 500°C using isochronal annealing. The W-parameter of Doppler broadened lineshape, related to core-electron annihilation, increased in two annealing stages below crystallization temperature. The increase is explained by the loss of excess free volume or liquid-like regions in the as-quenched amorphous alloy as structural relaxation. The existence of the two relaxation stages in this specimen is in good agreement of the results of the specific heat capacity study reported by Chen.

The Doppler broadened lineshape parameter has been measured in the amorphous $Fe_{40}Ni_{40}P_{14}B_6$ alloy and the crystallized amorphous alloy over the wide temperature range from 4.2 K to about 1000 K. The temperature dependence in the amorphous state can be divided into five distinctive parts in the following temperature range (i) A low temperature behavior caused by defects in the amorphous state. (ii) Normal linear temperature dependence. (iii) The change due to first relaxation. (iv) The change due to second relaxation. (v) crystallization. The remarkable difference at low temperature indicates the presence at the excess free volume or liquid-like regions in as-quenched amorphous alloys.

The Doppler broadened lineshape has been measured in germaniums with 2 MeV-electrons at room temperature. The positron lineshape parameter in specimens contained irradiation defects increases with decreasing temperature for the increase of positron trapping radius. The results of isochronal annealing revealed that there are no defects recovered in the temperature range from room temperature to 260°C. The result supports the interpretations that the recovery of divacancies takes place at room temperature as suggested by Hirata.