Structure of β-phase AuZn Alloy under High Pressure

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1. Introduction

β phase alloys composed of noble metals (Au, Ag, Cu) and divalent metals (Mg, Zn, Cd) are transformed into β_1 phases with CsCl, Fe_3Al or Heusler type structure by cooling or rapid quenching. The β_1 phases in general undergo the martensitic transformation by further cooling and/or under the stress field. AuZn alloy that has a CsCl type ordered structure in the β_1 phase below the melting point undergoes the trigonal martensitic transformation by cooling, yet, it is not clear whether a stress induced martensitic transformation occurs. The purpose of the present study is to study the AuZn martensitic phase under high pressure.

2. Experimental procedure

Filed Au-51.5at.%Zn alloy powder was used as the specimen. It was slow cooled after annealing at 773K for 5 minutes. A cubic boron-epoxy cell of 5 mm edge was used as a pressure medium. The sample was put in the center of the cell. A mixture of NaCl and BN powder was placed below the sample as an internal pressure marker. A pair of alumina pistons was put the upper and lower sides of them. The high pressure experiments were performed on MAX80 with 4 mm sintered diamond anvils. The MAX80 was installed at TRISTAN accumulation ring (AR) in KEK. The energy of the AR was 6.5 GeV, being the highest energy in Japan until the SPring-8 becomes available. The X-ray measurements were carried out by means of an energy dispersive method at room temperature. The energy range of incident x-rays was ranging from 40 to 120 keV.

3. Results

Figure 1 shows an X-ray diffraction profile of Au-51.5at.% Zn alloy at 9.48GPa and 0.2MPa (=1 atm) at room temperature. The indices of CsCl type order diffraction peaks, characteristic X-rays and absorption edge are shown. A detector was set at $2\theta = 9$ degree. The peak profiles are broad. It is not clear that every peak at 9.48GPa consists of several martensitic peaks that appear at low temperature. The neutron diffraction profile of Au-51.5at.%Zn alloy at room temperature and 25K at 1 atm measured by Makita *et al.* are shown in Fig. 2 for reference. One has to analyze the peaks from the viewpoint of the intensity to make it clear that the peaks under high pressure are originated from a martensitic phase. For intensity analysis, monochromatic high brilliance x-rays are needed. That analysis should be done when SPring-8 becomes available.

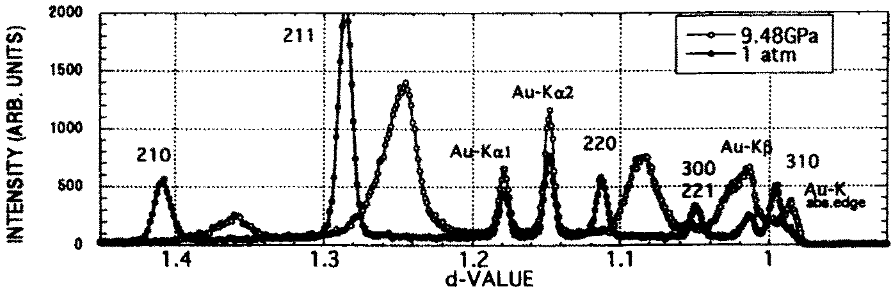

Fig.1. X-ray diffraction profile of Au-51.5at.%Zn alloy at 9.48GPa and 0.2MPa (=1 atm) at room temperature.

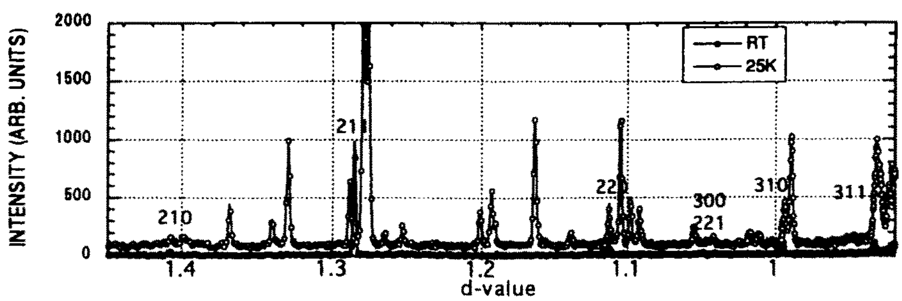

Fig.2. Neutron diffraction profile of Au-51.5at.%Zn alloy at room temperature and 25K (1 atm).