Structure of ß-phase $AuCuZn_2$ Alloy under High Pressure

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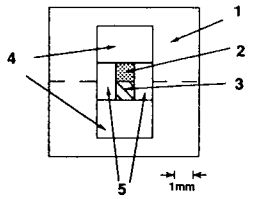
The premartensitic β_1 state of AuCuZn2 alloy has two types of lattice deformation waves that correspond to 18R and 6R type stacking periods[1,2]. We already know that by cooling, AuCuZn2 alloys have 18R type martensite phases, but not 6R type. The purpose of the present study is to determine a stacking structure in AuCuZn2 martensitic phase under high pressure expecting an appearance of 6R period.

Filed Au-26at.%Cu-48at.%Zn alloy powder was used as the specimen. It was quenched into ice water after annealing at 773K for 5 minutes. Sample assembly is shown in Fig.1. The sample was encapsulated in a teflon tube in the center of a pressure transmitting cube that is made of boron and epoxy resin. A mixture of NaCl and BN powder was placed below the sample as an internal pressure marker. A pair of sintered diamond pistons was put on the upper and lower sides of teflon tube in order to make uniaxial stress. The high pressure experiments were made on MAX80 installed at TRISTAN accumulation ring (AR) in KEK. The energy of the AR is 6.5 GeV, being the highest energy in Japan until the SPring-8 will be 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 is from 40 to 120 keV.

Fig.2(a) shows a diffraction profile of the β_1-phase at 1 atm (detector being set at 2θ=8 degrees). The martensitic transformation occurred at 20MPa. Fig.2(b) shows the martensitic phase at 2 GPa (detector being set at 2θ=6 degrees). As a result of analyzing this pattern, the stacking period was found



1 Boron + Epoxy Resin
2 Sample ($AuCuZn_2$)
3 Pressure Marker (NaCl + BN)
4 Sintered Diamond
5 Teflon

Fig.1. Sample assembly. (Cross section)

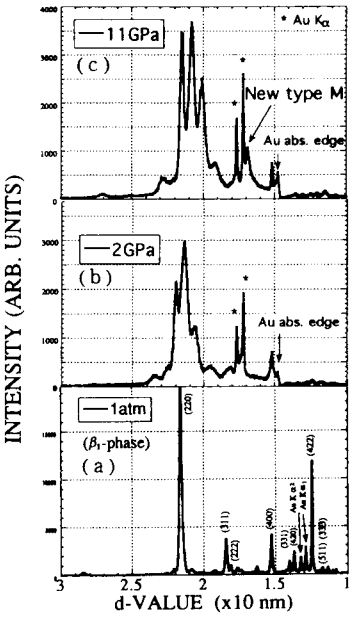


Fig.2. X-ray diffraction profile of Au-26at.%Cu-48at.% Zn alloy under pressure. (a) P=0.2MPa (=1 atm), (b) P=2GPa, and (c) P= 11GPa.

to be 18 layers. Successive application of pressure induced new peaks at 11GPa as shown in Fig.2(c) indicating an existence of 6R type period. This change means that a martensite-martensite transformation occurred. Thus, this new phase corresponds to the lattice deformation waves having a 6 layer period in the premartensitic β_1 state.

For intensity analysis, it will need monochromatic high brilliance x-rays. That analysis will achieve when SPring-8 will be available.

References

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