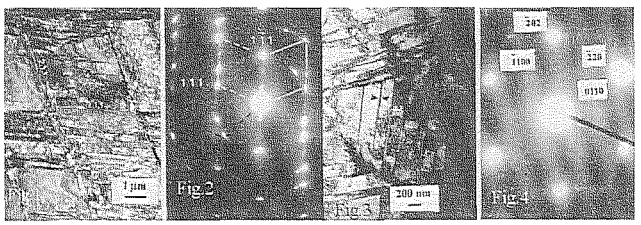
PS11.05.23 CRYSTAL STRUCTURE AND MAGNETIC PROPERTIES OF $R(T,M)_{13}$ COMPOUNDS. Jingkui Liang, Guanghui Rao, Weihua Tang, Yanming Zhao, Yongquan Guo, Xiaohua Yan, Institute Of Physics, Chinese Academy Of Sciences, Beijing 100080, P.R. China

Rare earth (R) transition metal (T) intermetallic compounds, especially those rich in T, have attracted considerable attention owing to their potential application as permanent magnets. The stability, crystal structure and magnetic properties of $RT_{13-x}M_x$(R=La,Ce,Pr,Nd; T=Co,Fe; M=Al,Si) were investigated by means of x-ray powder diffraction and magnetic measurements. Cubic $NaZn_{13}$-type or its derivative structure was obtained in $LaCo_{13-x}Al_x$($0\leq x \leq 2.7$), $LaCo_{13-x}Si_x$ ($0\leq x \leq 5.0$),$LaFe_{13-x}Al_x$ ($1.95\leq x \leq 7.15$), $LaFe_{13-x}Si_x$ ($1.4\leq x \leq 5.0$), $CeCo_{13-x}Si_x$ ($3.2\leq x \leq 4.0$); $CeFe_{13-x}Si_x$ ($2.4\leq x \leq 2.6$), $PrCo_{13-x}Si_x$($1.5\leq x \leq 4.0$), $NdCo_{13-x}Si_x$ ($2.5\leq x \leq 4.0$), $LaCo_{13-x}Fe_x$ ($0\leq x \leq 6$), $LaFe_3Co_{10-x}Si_x$ ($0\leq x \leq 4.0$), $LaCo_{10-x}Fe_xSi_3$ ($0\leq x \leq 5$), $La_{1-x}Ce_xFe_{10.5}Si_{2.5}$ ($0\leq x \leq 1$) and $La_{1-x}R_xCo_9Fe_4$ ($0\leq x \leq 0.2$). When T and M distribute randomly in the structure, $R(T,M)_{13}$ belongs to cubic $NaZn_{13}$-type structure, which could be transformed to a tetragonal or orthorhombic $NaZn_{13}$-derivative structure in some composition regions by proper heat treatments. The composition dependences of Curie temperature and saturation magnetization of $R(T,M)_{13}$ compounds were studied. The magnetocrystalline anisotropy in the $NaZn_{13}$-derivative structure is generally a little larger than that in the cubic $NaZn_{13}$-type structure. The relationship between crystal structure and magnetic properties was discussed.

PS11.05.24 DEFORMATION INDUCED MARTENSITIC PHASE TRANSFORMATION IN STAINLESS STEEL TYPE OF 304L Ping Liu*, Laizhu Jiang** & Åke Roos**, *Dept. of Physical Metallurgy, **Dept.of Wire Research & Development, Research and Development Centre, AB Sandvik Steel S-811 81 Sandviken Sweden.

Deformation induced ε-martensitic phase transformation was observed in stainless steel type of 304L. Fig.1 shows a transmission electron microscope(TEM) micrograph of thin foil from a deformed stainless steel type 304L (0.03 C-1.0 Si-2.0 Mn-18.0-20.0 Cr-8-12 Ni). Note that there are two sets of twins, between which there is an interaction zone as indicated by the arrow. Electron diffraction pattern from the twins is shown in Fig.2. More importantly, ε-martensite was observed as shown in Fig. 3. The thickness of ε-martensite is about 20 nm. Fig.4 show composite electron diffraction patterns of {111} γ-austenite and <0001> ε-martensite, which reveals the orientation relationship: $\{0001\}_\varepsilon$ // $\{111\}_\gamma$ and $<11\bar{2}0>_\varepsilon$// $<110>_\gamma$. Hence, the formation of ε-martensite attributed to low stacking fault energy in 304L stainless steel. The elements of Cr, Mn, Co, Si, C, N tend to lower stacking fault energy in γ-austenite and hence, promote the formation of twin and the transformation of γ-austenite to smartensite during deformation because an extrinsic stacking fault is a twin embryo and intrinsic is an hcp embryo(1).

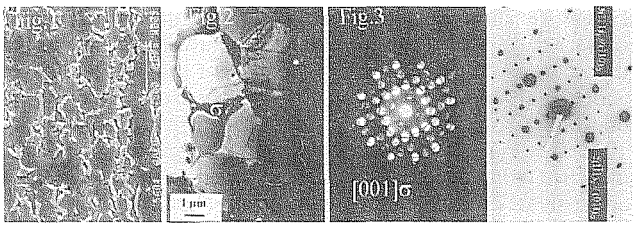
1.G.B. Olson and M. Cohen, Metall. Trans.7A. 1976(1897-1904).



PS11.05.25 PRECIPITATION OF σ-PHASE IN DUPLEX STAINLESS STEEL ZERON-100 Ping Liu, Dept. of Physical Metallurgy, Research and Development Centre, AB Sandvik Steel S-811 81 Sandviken Sweden.

Precipitation of σ-phase (FeCr, $P4_2/mnm$, a=8.790 Å and C=4.545 Å) was observed in welded metal of duplex stainless steel Zeron-100. Fig.1 shows a scanning electron microscope(SEM) micrograph of welded metal of Zeron-100(0.04 C-0.33 Si-0.87 Mn-24.49 Cr-8.93 Ni-0.67 Cu- 0.74 W). Transmission electron microscope(TEM) micrograph in Fig.2 shows that precipitation of σ-phase took place at the grain boundaries and α-ferrite and γ-austenite boundaries. Fig.3 shows a convergent beam electron diffraction pattern (CBED) from [001] zone axis of σ-phase. Note that the presence of the M-G lines in the odd h00 and 0k0 reflections is dynamic absences due both to glide planes parallel to the zone axis and screw axes perpendicular to it. The composite electron diffraction patterns of $[1\bar{1}0]_\gamma$//$[1\bar{1}1]_\sigma$ in Fig.4 reveals that precipitation of σ-phase obeys the following orientation relationship (O.R.) to gaustenite (Fm3m, a=3.585 Å): $[110]_\gamma$//$[111]_\sigma$; $(\bar{1}11)_\gamma$// $(01\bar{1})_\sigma$, $(\bar{1}11)_\gamma$//$(\bar{1}10)_\sigma$, which differs from the previously reported ones (1-2). The smaller lattice misfit in the present case provides an explanation for the occurrence of this O.R.

1.) M. H. Lewis, Acta Met., 1966, **14**, 1421.
2) F. R. Beckitt, J. Iron Steel Inst., 1969, **207**, 632.



PS11.05.26 EQUATION OF STATE AND PRESSURE-INDUCED PHASE TRANSITION IN AlN: RESULTS FROM IN-SITU X-RAY AND RAMAN SCATTERING STUDIES. Murli H. Manghnani, L. C. Ming and V. Vijaykumar*, Mineral Physics Group, Hawaii Institute of Geophysics and Planetology, University of Hawaii, Honolulu, HI 96822 USA

Like the other nitrides of III-V group, AlN commonly crystallizes in the wurtzite structure at room temperature. Complementary in-situ high pressure X-ray diffraction (EDXRD), using synchrotron radiation, and Raman scattering studies have been carried out on AlN in a diamond-anvil cell at room temperature to 30 and 20 GPa, respectively. The main objectives were to determine as well as to characterize the phase transition from wurtzite (hexagonal) to rock salt (cubic) structure, and to establish the equation of state (pressure-volume relationship) for the two phases. Previous studies have reported the pressure of this transition to range from ~16.5 to 22.9 GPa. Our Raman results clearly show a continuous change of wurtzite structure to rock salt structure, beginning at pressure as low as 14 GPa, as evidenced by the splitting of A_1(TO) and E_2(2) modes. The pressure dependencies of all the six observed Raman modes are found to be a linear function of pressure.

The X-ray data on the other hand show the transition to occur at higher pressure (~23 GPa). The P-V relationships for the two phases are deduced. There is a good agreement between the K_o (bulk modulus) and K_o' values for the wurtzite phase deduced from the X-ray data and ultrasonic measurements on a polycrystalline specimen of AlN.

The above results are discussed in light of the previously reported shock wave results and theoretical studies.

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