21-Crystallography at Non-Ambient Temperatures and/or Pressures: Phase Transitions

The γ-solid solutions in some steels are unstable during aging. This instability is connected with partial exsolution of the carbon from solid solution and, as a result, austenite lattice parameters are seen to decrease in some temperature ranges. Formation of the new phases, physical and mechanical properties are due to change in carbon content in austenite thermal instability range. Fe-12wt%Mn-1.1wt%Cr and Fe-11wt%Mn-1.1wt%Al alloys with many crystal structures have been selected for investigation. The austenite thermal instability range is determined by step heating by X-ray powder diffraction. In the carbon-containing alloy, the thermal instability occurs in the temperature range 500-600°C and at 400-500°C for the nitrogen-containing one. This difference is connected with differences in the mobility of carbon and nitrogen. In the thermal instability range, the precipitation of carbide and nitride is found by qualitative analysis. The quantity of carbon (nitrogen) at maximum temperature instability is evaluated. The results of investigations show that only some part of the carbon or nitrogen in the alloy formed the carbide or nitride. Probably, the remainder of carbon (nitrogen) precipitates as atoms in the structure of defects. After heating, defects induce a high pressure which forces carbon and nitrogen in octa- and tetraquitos of the bcc lattice of austenite. Increase of lattice parameters in γ-solid solution conforms to this assumption as temperature conditions where the solubility of carbide or nitride is hardly possible. Thus the greater stability of the nitrogen-containing γ-solid solution over the carbon-containing γ-solid solution is related to the different mobilities of carbon and nitrogen. Part of carbon or nitrogen precipitated forms carbide or nitride, and the remainder is concentrated in defects in atomic state.

PS-2103.25 STUDY ON THE SELF-PHASE-TRANSITION CHARACTERISTIC OF ULTRAFINE PARTICLES BY LIU Cunye*, DENG Zhaojiong, REN Hongkang and LI Jian, Department of Physics Southwest China Teachers University, Chongqing, Sichuan China, 630071

The study of the atomic structure has been extended to ultrafine particles (UFP) containing hundreds and millions of atoms, the macroscopic concepts of surface energy and chemical potential is applied to investigate the surface structure of UFP, the growth process of UFP is described by using the equation of macroscopic theory to be revised. By experiment and theoretical research, we find that UFP possesses one kind of the characteristic of the self-phase-transition (SPT), namely, UFP has a trend of spontaneous phase transition, it is a new SPT effect in this paper. The SPT process of UFP does not need that rigorous surroundings condition, which is necessary for the phase transition process of macroscopic matter (such as our surroundings temperature, pressure, surrounding atmosphere, etc.). The SPT process of UFP depend on own microstructure, particle size, morphology etc. The size-dependence of the SPT process submits to a power-law. We have done a preliminary research for the SPT mechanism of metal and metal oxide UFP.

PS-2103.26 THE ISOTHERMAL SECTION OF THE PHASE DIAGRAM OF Ag-Cu-Y TERNARY SYSTEM AT 500°C BY D.N.I.L.M. Zeng* and Y.H. Zhang, Department of Physics, Guangxi University, Nanning 530004, China.

The isothermal section of the phase diagram of Ag-Cu-Y ternary system (Cu > 50wt.%) at 500°C has been investigated by X-ray diffraction. The section consists of seven single-phase regions: a-Cu, CuY, Cu2Y, Cu3Y, Cu5Y and Ag2Cu2Y (Phaseshift two-phase regions: Ag+Cu2Cu4Y, Cu2Y+Ag, Cu4Y+Ag, Cu5Y+Ag, Cu6Y+Ag, Cu7Y+Cu4Y and Cu8Y+Cu4Y and ten three-phase regions: Ag+Cu2Y+Ag, Cu4Y+Cu4Y+Ag, Cu5Y+Cu4Y+Ag, Cu6Y+Cu4Y+Ag, Cu7Y+Cu4Y+Ag, Cu8Y+Cu4Y+Ag and Ag2Cu2Y+Ag. A new ternary compound (t phase) has been found. The compound, which is Ag2Cu2Y, has a limited solid solubility. The composition range is 23-27wt.%Y, 9-19wt.%Ag. Phase has a cubic structure of B-Mn (A13) type with a = 7.127(4) Å, at 25°C. The maximum solid solubility of silver and yttrium in a-Cu at 500°C is 0.8at.% and 1.5at.%, respectively.

PS-2103.27 THE CHANGE OF THE PHASE COMPOSITION OF THE NATURAL URANIUM OXIDE BY HEATING L.V. Zvagodinskaya*, V.N. Shnanov, A.V. Timofeev. Institute of the geology of the ore deposits, petrography, mineralogy and geochemistry, Russian Academy of Sciences, Moscow, Russia; *Moscow State University, Moscow, Russia.

The changes of the morphology and phase composition of the pitchblende by the heating from 25°C to 500°C were analyzed by the thermic microscopy and X-ray diffraction (the heating rate 10°C/min). For the investigation the cubic pitchblende (Ag = 5.433 ± 0.018 Å) from one of the uranium deposits (North Kazakhstan) was picked out. The surface of the mineral heated to 200°C does not change; the parameter Ag being practically constant. In the range of 350 - 700°C the pitchblende is oxidized; this process is accompanied by the formation of uraninite. It proceeds most intensively at 405 - 510°C and probably is connected with the partial polymorph conversion of the former formed rhombohedrable into the hexagonal modification. From 765°C the sample surface is warped, the fracture size being increased. At 800°C the pitchblende spherolites are descripted into the smaller ones. In the range of 855 - 900°C the mineral surface slowly raises over the netal container bottom.