MS13-P11

In-situ temperature X-Ray diffraction and mechanical study of the binary yellow 18-carat gold alloy AuCu

Mohammed Said M. Abdelbaky[1], Imene Lamiri[2], David Martínez Blanco[3], Djamel Hamana[2], Santiago García Granda[1]

1. Department of Physical and Analytical Chemistry, University of Oviedo-CINN, Oviedo, Spain
2. Research Unit of Material Science and Applications, Science Faculty, University Constantine 1, Constantine, 2500- Algeria , Constantine, Algeria
3. Scientific and Technical Services, University of Oviedo-CINN, Oviedo, Spain

email: saidmohammed.uo@uniovi.es

Regarding to the huge impact that have the phase transition sequences and temperatures on the physical properties of the alloys, the study of these phenomena has a practical importance[1-3].Herein, In-situ temperature XRD and mechanical spectroscopy were applied to study phase transitions in AuCu alloy. The measurements have been carried out from room temperature up to 973K from the ordered state AuCuI as starting phase. The phase transition sequences, was investigated upon heating using heating rate of 1K/min. The sequences of phase transitions presentimportant results that depend crucially to the starting state. This transition sequences determine temperature dependency of elastic and anelastic properties. The mechanical spectroscopy using forced torsion pendulum shows twin boundaries peak as typical peak of the orthorhombic phase AuCuII according to the thermal tests. The isothermal frequencies measurements have shown the behaviors of the thermally activated peaks in the phase transitions intervals.

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References:

[1] A. K. Maier, I. Tkalcec, D. Mari, R. Schaller, Mater. Sci. Eng., A. 560 (2013) 466-472.
[2] A. K. Maier, I. Tkalcec, D. Mari, R. Schaller, Solid State Phenomena. 184 (2012) 283-288.
[3] A. K. Maier, I. Tkalcec, D. Mari, R. Schaller, Acta Mater. 74 (2014) 132-140.

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MS13-P12

High-Accuracy measurement of cell dimensions of the vanadium α- and β-phases in V-O System

Boris Kodess[1], Igor Kommel[1], Vladimir Volodin[1], Alexander Alpatov[2], Sergey Muradyan[2]

1. CMD,Materials Science -VNIIMS-ICS&E, Moscow, Aurora, Russia
2. IMET RAS, Moscow, Russia

email: kodess@mail.ru

We observe traceability of high-purity vanadium properties in the oxides and chemical bonds of minerals and related materials. High-accuracy measurements using conventional and synchrotron X-Ray methods have been carried out to determine structural characteristics of single crystals zone melting vanadium. The impurity content for possible 34 elements in the investigated crystalline samples was estimated, using an M1 Mistral micro-fluorescence spectrometer (of Bruker firm). The vanadium content was estimated from the measurement results as 99.98%. The oxygen and nitrogen content (mass fraction, %) in the samples was determined using a TC600 analyzer (LECO), by reducive melting in a graphite crucible in an inert gas (helium) flow. The hydrogen content was determined using the RHEN602 analyzer (of LECO firm) by reducive melting in a graphite crucible in an inert gas (argon) flow. The average value of oxygen concentration was 900 ppm w, nitrogen – 200 ppm w, and, importantly, hydrogen was only 40 ppm w. To assess the effect of the purity of single crystals on mechanical properties, Vickers hardness measurements (Hardness tester 930N from Wolpert firm) were performed. The obtained hardness value of 135 HV indicates the acceptable purity of the single crystals used.

Both types of samples – α-phase and β-phase – were investigated using a CCD detectors, MoKα1-radiation, and a wavelength of 0.070932 nm. 1900 to 2500 Bragg reflections were collected for each of the three samples for the α-phase at room temperature, to fill to maximum the entire Ewald sphere. The spatial group of the unit cell is Im-3m (No. 229). The average value of the three experiments of the unit cell dimension (lattice constant) was 0.303465(5) nm. Two similar complete experiments were performed in the same way for spherical single crystals of the vanadium β-phase. At room temperature, from 2200 to 2800, the Bragg reflections are collected. It was found that the value of one of the dimensions of the unit cell of the β-phase was a = 0.30409(2), which was close to the value of the lattice constant of α-phase of vanadium. For the second constant of the tetragonal unit cell, the value was b = 0.3373(5) nm. The latter value noticeably increased because of additional introduction of oxygen into this unit cell. Thus, the use of data on the original elements with a minimum content of oxygen impurities allows to extract and establish the inherited structural features in various vanadium-content chemical compounds and alloys [1-3]

References:

Kodess, B. N., Butman, L. A., & Poraj-Koshits, M. A. (1982). Kristallografiya, 27(3), 606-607.
Bader, R. F., & Matta, C. F. (2001). Inorg chemistry, 40(22), 5603-5611
Kodess B.N., et al. (2008) Acta Crystal. Found. Cryst. 64(A1), 569

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