COMPARATIVE STUDY OF THE AL-MN-PD AND AL-MN-NI ALLOY SYSTEMS AT 850 AND 750 °C

V. T.Ya. (1), S. Balanetskyy (1,2), M. Feuerbacher (2)

(1) I.N. Frantsevich Institute for Problems of Materials Science, 03680 Kiev 142, Ukraine,
(2) Institut für Festkörperforschung, Forschungszentrum Jülich, D-52425 Jülich, Germany,

Al-Mn-Pd and Al-Mn-Ni belong to a group of alloy systems exhibiting formation of quasicrystals and complex metallic alloy phases structurally related to the quasicrystals [1, 2]. While in Al-Mn-Pd, stable icosahedral (I) as well as decagonal (D3) phases exist [1], only metastable quasicrystals were found in Al-Mn-Ni [2]. Formation rules of the quasicrystalline and periodic phases in the Ni and Pd containing systems are of a basic interest considering the chemical similarity of these elements and some differences in their atomic radii.

In spite of the fact that Al-Mn-Pd has intensively been investigated during the last two decades, thermodynamic stability of some of the phases still unclear. For example, three orthorhombic structures related to the so-called Taylor phase, which have similar period b=1.24 and different periods a and c: a=1.92 and c=6.14; a=5.05 and c=3.78; a=8.4 and c=6.2. They have very large unit cells and unclear thermodynamic stability [3]. The same holds for the so-called \( \xi \) (\( Cmcm \), \( a=1.9960, b=1.6566, c=1.4549 \) nm) and \( R \) (\( Bbmm \), \( a=2.3812, b=1.2510, c=0.7784 \) nm) identified in [4] as thermodynamically stable phases, which is in contrast with [5, 6] where these phases were not found in equilibrated samples.

The Al-Mn-Ni alloy system was investigated significantly less intensively. Three ternary phases, \( R \) (the so called Robinson phase) [7], \( C_{3.1} \) (\( Prim., a=2.40, b=1.24, c=3.27 \) nm) and \( C_{3.2} \) (\( a=1.36, b=1.26, c=1.24 \) nm; \( \beta=99.46^\circ \)) [2], were known before our study, but their stability was unclear.

In the present study, we report on phase equilibria in the Al-rich part of Al-Mn-Pd and Al-Mn-Ni alloy systems at 850 and 750 °C. Significant differences on constitution of isothermal sections of Al-Mn-Pd and Al-Mn-Ni at those temperatures were revealed and discussed.

References