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Americium alloys with gold and copper

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Over many years JSC "SSC RIAR" has been performing activities on the production and investigation of metals of transplutonium elements (TPE), their alloys and compounds.

This paper presents the results of production and X-ray examination of micro-samples of americium-241 compounds with gold and copper, i.e. identification of crystal structures of the compounds obtained and calculation of crystal lattice parameters, study of the effect of alpha-decay on the intermetallide crystal structures. Samples of Am-Au and Am-Cu systems were prepared by high temperature condensation of metal americium vapor onto appropriate substrates. The X-ray examination results of the compounds produced are shown in the table below.

Table. Crystal lattice parameters of phases detected during investigation of Am-Au and Am-Cu systems

System Phase Syngony

(space group) Lattice parameters

a, Å b, Å c, Å V, Å³

Am-Au Au₆Am Tetragonal (P4₂/ncm) 10.3894(7) - 9.7036(7) 1047.4(2)

AuAm Orthorhombic (Pnma) 7.402(2) 4.564(1) 5.826(1) 196.8(1)

AuAm Cubic (Fm3m) 4.784(2) - - -

Am-Cu Cu₅Am Hexagonal (P6₃/mmm) 4.958(1) - 4.175(2) 88.88(5)

Note. V – is volume of a crystal lattice elementary cell. Definition errors of the last character are given in brackets after the lattice parameter values.

The investigated systems did not show mutual solubility of their components at room temperature.

In the Am-Au system three intermetallic compounds were found: Au₆Am (of Au₆Sm structural type), AuAm (of CuCe structural type) and intermetallide AuAm (of CsCl structural type).

In the Am-Cu system intermetallide Cu₅Am (Cu₇Am) (of Cu₅Ca structural type) was detected. The effect of alpha-activity of nuclide ²⁴¹Am on crystal structure of the obtained intermetallide (Fig.) was investigated.

Fig. Change in the elementary cell volume of intermetallide Cu₅Am as a function of self-irradiation time.

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