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**Characterization of new aluminides found in the  $\text{ThT}_2\text{Al}_{20}$  alloys (where T=Ti, V, Mn)**Avraham I. Bram<sup>a,b</sup>, Arie Venkert<sup>c</sup>, Louisa Meshi<sup>a,b\*</sup><sup>a</sup> *Department of Materials Engineering, Ben-Gurion University of the Negev, 84105 Beer-Sheva, Israel*<sup>b</sup> *Ilse Katz institute for Nanotechnology, Ben Gurion University of the Negev, 84105 Beer-Sheva, Israel*<sup>c</sup> *Nuclear Research Center - Negev, P.O. Box 9001, 84190 Beer-Sheva, Israel***\*Email of corresponding author:** [louisa@bgu.ac.il](mailto:louisa@bgu.ac.il)**Abstract**

During the investigations on the Al-rich corner of the Th-T-Al system (where T=Ti, V, Mn), new intermetallic phases were revealed: ternary  $\text{ThV}_2\text{Al}_{20}$ ,  $\text{ThTi}_2\text{Al}_{20}$ ,  $\text{ThMn}_2\text{Al}_{10}$  and pseudo-binary  $\text{Th}_3\text{Al}_{11}$  (containing traces of vanadium). Their structure was investigated by means of Transmission Electron Microscopy and powder X-ray diffraction methods. Refinement of these structures was performed applying Rietveld analysis on X-ray diffraction data. It was established that  $\text{ThV}_2\text{Al}_{20}$  and  $\text{ThTi}_2\text{Al}_{20}$  phases can be ascribed to the  $\text{CeCr}_2\text{Al}_{20}$  structure type, while  $\text{ThMn}_2\text{Al}_{10}$  possesses the  $\text{YbFe}_2\text{Al}_{10}$ -type structure. The pseudo-binary  $(\text{Th}_{1-x}\text{V}_x)_3\text{Al}_{11}$  phase was found to be orthorhombic (*Immm*;  $a=4.4354(8)$  Å,  $b=13.8394(9)$  Å and  $c=10.3486(5)$  Å), isostructural to  $\text{La}_3\text{Al}_{11}$ . It was proposed that metastable  $\text{Th}_3\text{Al}_{11}$  phase can be stabilized by small amount of vanadium, which was found in its content.

**Keywords:** aluminides; structure solution; TEM; powder X-ray diffraction**1. Introduction**

Intermetallic compounds based on f-elements may yield formation of heavy fermion ground state. For example, a large number of actinide/lanthanide-based intermetallics have been characterized as heavy-fermion systems [1, for example]. As a result of these findings, A-T-Al systems (where A=actinides and T=transition metals) were investigated thoroughly in the last decades. These researches have resulted in characterization of numerous aluminides, classified into families according to their structure types. For example: family of cubic  $\text{AT}_2\text{Al}_{20}$  phases (belonging to the  $\text{CeCr}_2\text{Al}_{20}$  structure type, which can be seen as an ordered variant of the  $\text{Cr}_2\text{Mg}_3\text{Al}_{18}$  type) [2-3, as an example],  $\text{A}_6\text{T}_4\text{Al}_{43}$  (belonging to the  $\text{Ho}_6\text{Mo}_4\text{Al}_{43}$  structure type) [4, for example] and  $\text{AT}_2\text{Al}_{10}$  (belonging to the  $\text{YbFe}_2\text{Al}_{10}$  structure type) [5-7, for example]. During our investigation of the Th-T-Al system (where T=Ti, V and Mn),

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