Structure and Properties of the Stannide $Eu_2Au_2Sn_5$, and its Relationship with the Family of $BaAl_4$-Related Structures

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The stannide $Eu_2Au_2Sn_5$ was prepared by high-frequency melting of the elements in a sealed tantalum tube. The structure of $Eu_2Au_2Sn_5$ was refined from single crystal X-ray data: $P2_1/m$, a = 928.6(2), b = 465.8(2), c = 1042.9(3) pm, β = 92.28(2)°, $wR2$ = 0.0653, 1220 F^2 values and 56 variables. The structure of $Eu_2Au_2Sn_5$ is of a new type. It can be considered as an ordered defect variant of the $BaAl_4$ type. Due to the ordered defects, the coordination number (CN) of the two crystallographically different europium sites is reduced from CN 16 to CN 14. The gold and tin atoms in $Eu_2Au_2Sn_5$ form a complex three-dimensional $[Au_2Sn_5]$ polyanion in which the europium atoms are embedded. Within the polyanion short Au-Sn and Sn-Sn distances are indicative of strongly bonding Au-Sn and Sn-Sn interactions. A detailed group-subgroup scheme for various ordered and defect variants of the $BaAl_4$ family is presented. $Eu_2Au_2Sn_5$ shows Curie-Weiss behavior above 50 K with an experimental magnetic moment of 7.90(5) μ_B/Eu, indicating divalent europium. Antiferromagnetic ordering is detected at 5.8(5) K at low fields and a metamagnetic transition occurs at a critical field of 1.4(2) T. $Eu_2Au_2Sn_5$ is a metal with a specific resistivity of 150±20 $\mu\Omega$cm at room temperature. The results of ^{151}Eu and ^{119}Sn Mössbauer spectroscopic experiments are compatible with divalent europium and show complex hyperfine field splitting with a transferred magnetic hyperfine field at the tin nuclei at low temperature.