

Tuning the structural transition by chemical substitutions in $\text{Eu}_3\text{Ir}_4\text{Sn}_{13}$ intermetallic compound

Ana L. A. Ribeiro*, Camilo B. R. Jesus, Jean C. Souza, Mario M. Piva, Matheus Radaelli, Pascoal G. Pagliuso

Resumo

The intermetallic compound $\text{Eu}_3\text{Ir}_4\text{Sn}_{13}$ is known to present a peculiar structural distortion at $T_S \sim 60\text{K}$ and an antiferromagnetic transition at $T_N \sim 11\text{K}$. [1]. In this work, $\text{Eu}_3\text{Ir}_4\text{Sn}_{13}$ single crystals were grown by Sn self-flux technique and a small percentage of Ga was added. We will show how Ga-substitution affects the transitions and, compare with previous hydrostatic pressure results, we discuss the relation between the structural transition and the magnetic and electronic properties of the compound.

Palavras-chave:

$\text{Eu}_3\text{IrSn}_{13}$, structural transition, antiferromagnetic transition

Introdução

The series of intermetallic compounds $\text{R}_3\text{M}_4\text{Sn}_{13}$ ($\text{R} = \text{La}, \text{Ce}, \text{Pr}, \text{Eu}, \text{Ca}, \text{Sr}, \text{etc}$) and $\text{M} = \text{transition metal such as Rh, Ir, Co}$) have been subject of intense scientific investigation due to their interesting properties, such as heavy-fermion behavior, magnetic ordering and superconductivity. [2] The structural transition present in some Sn-based 3-4-13 compounds and consists in a displacement of the Sn ions inside its cage

It has been previously reported that T_S is strongly shifted to low temperatures under applied hydrostatic pressure, while T_N is nearly unaffected in the same pressure range. [3]

We will show how Ga-substitution in the Sn site affects both transitions and by comparing our results with the previous ones under pressure, we discuss the interplay between this structural transition and the electronic and magnetic properties of this compound.

Resultados e Discussão

Sample I has some Ga-substitution detected by elemental analysis ($x \sim 1\%$) and Sample II has no detectable Ga-substitution, although they are from the same batch.

In fig 1 and 3 we see that antiferromagnetic transition is almost unaltered ($T_N \sim 12\text{K}$) being just slightly higher than pure $\text{Eu}_3\text{Ir}_4\text{Sn}_{13}$.

Structural transition is shown in electrical resistivity and heat capability with $T_S \sim 45\text{K}$ (Sample I) and $T_S \sim 60\text{K}$ (Sample II), therefore transition is shifted to lower temperatures due to Ga-substitution.

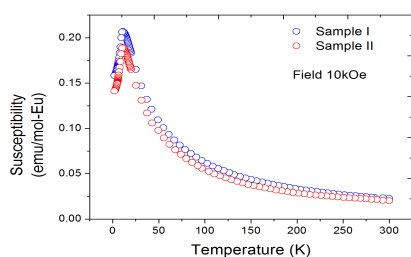


Figura 1. Magnetic Suceptibility

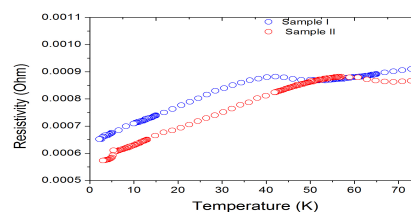


Figura 2. Electrical Resistivity

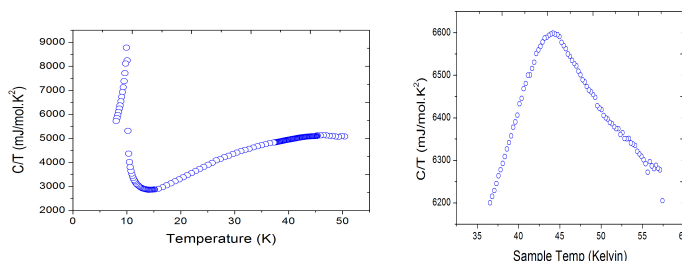


Figura 3. Heat Capability

Conclusão

T_S is shifted to lower temperatures under Ga-substitution of Sn sites and T_N is barely altered. Therefore, the effects of chemical substitution on $\text{Eu}_3\text{Ir}_4\text{Sn}_{13}$ crystals are similar to those of hydrostatic pressure.

On going experiments are aimed to study other Ga concentrations in order to establish a complete concentration dependant phase diagram for this compound.

Agradecimentos



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