Tuning the structural transition by chemical substitutions in Eu3Ir4Sn13 intermetallic compound

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Resumo
The intermetallic compound Eu3Ir4Sn13 is known to present a peculiar structural distortion at TS~60K and an antiferromagnetic transition at TN~11K. In this work, Eu3Ir4Sn13 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:
Eu3IrSn13, structural transition, antiferromagnetic transition

Introdução
The series of intermetallic compounds R3M4Sn13 (R = La, Ce, Pr, Eu, Ca, Sr, etc) and M = 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. 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 TS is strongly shifted to low temperatures under applied hydrostatic pressure, while TN is nearly unaffected in the same pressure range. 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~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 (TN ~12K) being just slightly higher than pure Eu3Ir4Sn13. Structural transition is shown in electrical resistivity and heat capability with TS~45K (Sample I) and TS~60K (Sample II), therefore transition is shifted to lower temperatures due to Ga-substitution.

Conclusão
TS is shifted to lower temperatures under Ga-substitution of Sn sites and TN is barely altered. Therefore, the effects of chemical substitution on Eu3Ir4Sn13 crystals are similar to those of hydrostatic pressure. On going experiments are aimed to study other Ga concentrations in order to stabilize a complete concentration dependant phase diagram for this compound.

Agradecimentos

Figura 1. Magnetic Susceptibility

Figura 2. Electrical Resistivity

Figura 3. Heat Capability


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