



Contribution ID: 162

Type: **Poster Presentation**

Relationship between the Thermal Expansion and Spontaneous Magnetization in $\text{LaFe}_{13-x}\text{Al}_x$ ($1.2 \leq x \leq 1.8$) Rare Earth Intermetallic Compounds

Tuesday 30 June 2015 14:00 (2 hours)

The Fe-based NaZn_{13} -type compounds $\text{LaFe}_{13-x}\text{M}_x$ ($\text{M}=\text{Si}, \text{Al}$) have attracted considerable attention because of their intriguing properties, such as magnetocaloric effect and abnormal thermal expansion. These unusual properties are of fundamental interest and have potential technical applications in cryogenic engineering when related materials operate in low temperature environment. The thermal expansion coefficient and spontaneous magnetization of rare earth intermetallic compounds $\text{LaFe}_{13-x}\text{Al}_x$ ($1.2 \leq x \leq 1.8$) have been investigated and relationships between them were considered. Results indicate that $\text{LaFe}_{11.6}\text{Al}_{1.4}$ and $\text{LaFe}_{11.4}\text{Al}_{1.6}$ show near zero thermal expansion behavior from room temperature to liquid helium temperature. And it has been found that the spontaneous magnetostriction is proportional to the square of the spontaneous magnetization, which proves that the thermal expansion has a close relation with the spontaneous magnetization.

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Session Classification: M2PoD - Cryogenic Materials IV: Physical Properties

Track Classification: ICMC-11 - Metallic and Composite Materials