



## Effects of Cr substitution on structural and magnetic properties in $\text{La}_{0.7}\text{Pr}_{0.3}\text{Fe}_{11.4}\text{Si}_{1.6}$ compound

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In an effort to explore the effect of substitution Fe by Cr in  $\text{NaZn}_{13}$ -type  $\text{La}_{0.7}\text{Pr}_{0.3}\text{Fe}_{11.4-x}\text{Cr}_x\text{Si}_{1.6}$  ( $x = 0, 0.06, 0.12, 0.26, \text{ and } 0.34$ ) compounds, the structure and magnetic properties have been investigated by high intensity of x-ray and neutron diffraction, scanning electron microscopy, specific heat, and magnetization measurement. It has been found that a substitution of Cr for Fe in this compounds leads to decrease in the lattice parameter  $a$  at room temperature but variation on Curie temperature ( $T_C$ ). While the first order nature of magnetic phase transition around  $T_C$  does not change with increasing Cr content up to  $x = 0.34$ . High intensity x-ray and neutron diffraction study at variable temperatures for highest Cr concentration  $x = 0.34$  confirmed the presence of strong magneto-volume effect around  $T_C$  and indicated the direct evident of coexistence across magnetic transition as characteristic of first order nature. The values of  $-\Delta S_M$  around  $T_C$  decrease from  $17 \text{ J kg}^{-1} \text{ K}^{-1}$  for  $x = 0$  to  $12 \text{ J kg}^{-1} \text{ K}^{-1}$  for  $x = 0.06$  and then increases with further increasing Cr content up to  $17.5 \text{ J kg}^{-1} \text{ K}^{-1}$  for  $x = 0.34$  under a change of 0–5 T magnetic field. Similar behavior on relative cooling power which is decrease from  $390 \text{ J kg}^{-1}$  for  $x = 0$  to  $365 \text{ J kg}^{-1}$  for  $x = 0.06$  at the beginning and then increases up to  $400 \text{ J kg}^{-1}$  for  $x = 0.34$ . From the point of this view with the