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Unusual Phase Transitions in Single Crystals of Gd$_5$Si$_{1.3}$Ge$_{2.7}$ and
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ORATION — Gd$_5$(Si$_x$Ge$_{1-x}$)$_4$ has been widely studied over the composition range
0.41<x<0.51 where the coupled magnetic and structural first order phase transi-
tions occur close to room temperature. It has a mixed phase region in the phase
diagram with both orthorhombic I and orthorhombic II phases for compositions
0.32<x<0.41. Previously we have used modified Arrott plots to determine the sec-
ond order phase transition temperature when it is suppressed by the first order phase
transition in samples with compositions x<0.51. we also used these modified Arrott
plots on the mixed phase composition of Gd$_5$Si$_{1.5}$Ge$_{2.5}$ (x = 0.375) to determine
the second order phase temperatures of both the monoclinic and the orthorhombic
II phases. We have now investigated two more single crystals of Gd$_5$Si$_{1.3}$Ge$_{2.7}$ and
Gd$_5$Si$_{1.4}$Ge$_{2.6}$ whose compositions fall in the mixed phase regions of orthorhombic I
and orthorhombic II in the phase diagram. The second order phase transition tem-
peratures of the samples were estimated to be 383 K for Gd$_5$Si$_{1.3}$Ge$_{2.7}$ and 365 K
for Gd$_5$Si$_{1.4}$Ge$_{2.6}$. These temperatures are much higher than the expected second
order phase transition temperature of orthorhombic II phase (280 K). This may be
due to the presence of the orthorhombic I phase in larger volume fraction.

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