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Critical behavior and magnetocaloric effect in monoclinic Cr_5Te_8

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Abstract

The critical behavior and magnetocaloric effects of the monoclinic Cr_5Te_8 single crystal have been studied by using magnetization measurements. Experimental results show that the paramagnetic (PM) to ferromagnetic (FM) phase transition is a second-order phase transition at $T_c = 222$ K. The detailed critical behavior analysis indicates that the values of critical exponents β, γ, and δ determined by the modified Arrott plots, the Kouvel-Fisher method as well as the critical isotherm analysis agree well with each other and fulfill the Widom scaling law. The critical exponents are close to those expected for the three-dimensional Ising model and the ferromagnetic interaction is at the boundary between long-range type and short-range one. In addition,the magnetocaloric property of monoclinic Cr_5Te_8 is consistent with the analysis of critical behavior.

Keywords:
Transition metal alloys and compounds, Crystal growth, Magentisation, Magnetocaloric, Magnetic measurements

1. Introduction

The binary chromium chalcogenides have been intensively investigated because of their rich magnetotransport and optical properties [1–8]. It has been predicted that some of them would be excellent candidates for half-metallic ferromagnets, which are key ingredients in high-performance spintronic devices [1, 2]. Among binary chromium chalcogenides, sulfides and selenides are usually antiferromagnetic metals or semiconductors [8–10], but tellurides are ferromagnetic (FM) metals [11–15]. These compounds ($Cr_{1-x}Te$,