



HOKKAIDO UNIVERSITY

Title	Magnetic Field-Temperature Phase Diagram of CeCoSi Constructed on the Basis of Specific Heat, Magnetoresistivity, and Magnetization Measurements: Single Crystal Study
Author(s)	Hidaka, Hiroyuki; Yanagiya, Shun; Hayasaka, Eikai et al.
Citation	Journal of the Physical Society of Japan, 91(9), 094701 https://doi.org/10.7566/JPSJ.91.094701
Issue Date	2022-09-15
Doc URL	https://hdl.handle.net/2115/94188
Rights	©2022 The Physical Society of Japan
Type	journal article
File Information	Supple_Data_JPSJ91,094701(2022).pdf



Supplemental Materials for “Magnetic Field–Temperature Phase Diagram of CeCoSi Constructed on the Basis of Specific Heat, Magnetoresistivity, and Magnetization Measurements: Single Crystal Study”

Hiroyuki Hidaka^{1*}, Shun Yanagiya¹, Eikai Hayasaka¹, Yuma Kaneko¹,
Tatsuya Yanagisawa¹, Hiroshi Tanida², and Hiroshi Amitsuka¹

¹*Graduate School of Science, Hokkaido University, Sapporo, Hokkaido 060-0810, Japan*

²*Liberal Arts and Sciences, Toyama Prefectural University, Toyama 939-0398, Japan*

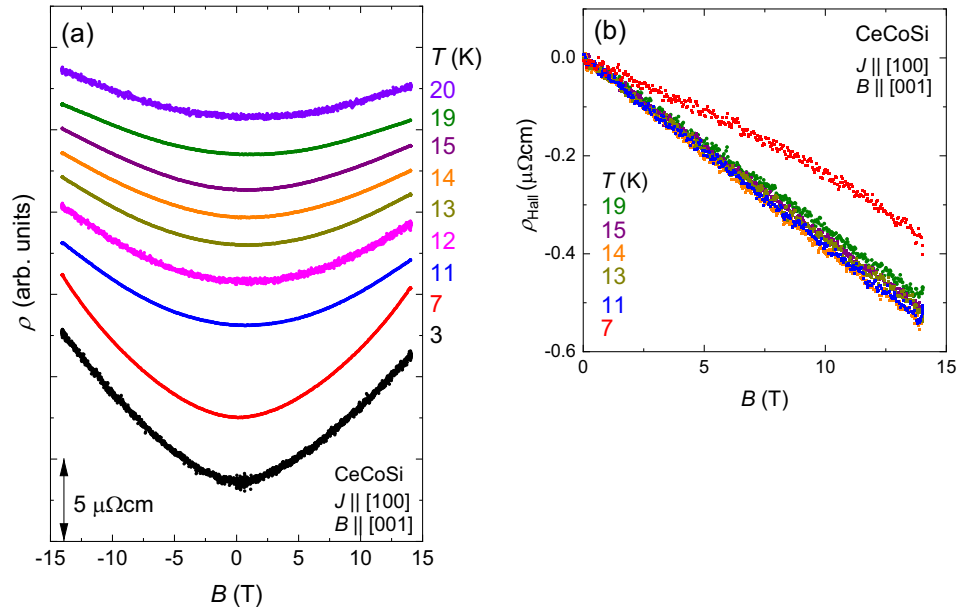


Fig. S1. (Color online) (a) Magnetic-field dependence of electrical resistivity $\rho(B)$ in CeCoSi (sample #1) below 20 K in the B range between -14 and 14 T. J was applied along the $[100]$ direction, while B was $[001]$. The data are shifted vertically for clarity. (b) A Hall effect component ρ_{Hall} mixed in the $\rho(B)$ data. The data measured at 3, 12, and 20 K are omitted in (b) due to low experimental precision.

1. Electrical resistivity for $B \parallel [001]$ and $J \parallel [100]$

Figure S1(a) shows the raw data of the magnetic-field dependence of electrical resistivity $\rho(B)$ for electric current $J \parallel [100]$ and magnetic field $B \parallel [001]$ below 20 K in CeCoSi (sample #1). These raw data are asymmetric with respect to B due to a Hall effect component ρ_{Hall} , which may come from a slight deviation of electrode arrangement from parallel. The ρ_{Hall} data shown in Fig. S1(b) were obtained by $[\rho(+B) - \rho(-B)]/2$. Here, the data measured at 3, 12, and 20 K are omitted in Fig. S1(b) because of low experimental precision. The ρ_{Hall} curves are proportional to B and their slope are almost unchanged, except for the data at 7 K. Further discussion on the Hall effect component is avoided here, because the present measurements were not done by an experimental setting for the Hall effect.

2. Magnetic susceptibility

Figures S2(a) and S2(b) show the temperature dependence of the magnetic susceptibility $[= M(T)/B]$ below 20 K in CeCoSi (sample #1) in magnetic fields up to 7 T for $B \parallel [100]$ and $[001]$, respectively. An upward bending at T_0 is observed in these $M(T)/B$ data except for the data at 1 T for $B \parallel [100]$. In addition, a clear kink is also observed at T_N . T_0 increases with increasing B for both field directions, while T_N decreases. These features are consistent with the results reported in the previous study.⁶⁾ It should be commented that the kink observed at T_N changes to a dip above 5 T for $B \parallel [100]$, suggesting a change in magnetic structure under high B region.

3. Magnetic field dependence of dM/dB between T_N and T_0

Figure S3 shows the B dependence of dM/dB in CeCoSi (sample #1) for $B \parallel [100]$ between T_N and T_0 . B_x determined by this measurement are plotted in Fig. 1(a) of the main text. At 10 K, B_x is considered higher than 7 T.

4. Reproducibility of magnetization measurements

To examine the reproducibility of the results of the M measurements using sample #1, we also performed the M measurements using another sample piece taken from a different batch, named sample #2. Figures S4(a) and S4(b) show the B dependence of dM/dB in sample #2 for $B \parallel [100]$ and $[001]$, respectively. The arrows near hysteresis represent the B increasing and decreasing processes.

*hidaka@phys.sci.hokudai.ac.jp

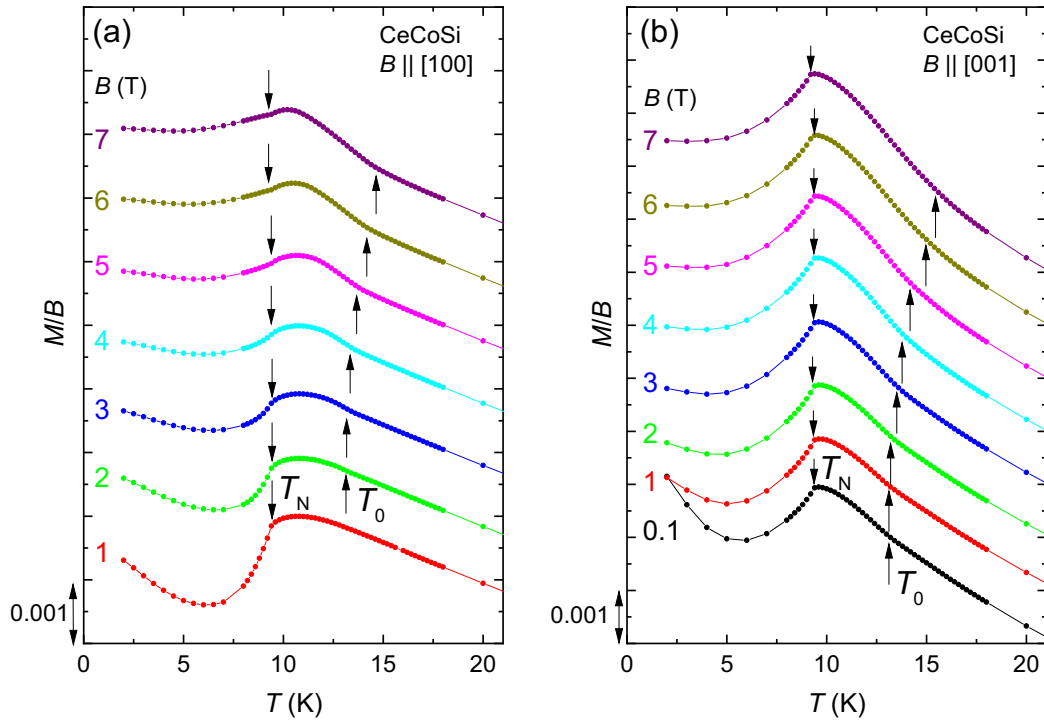


Fig. S2. (Color online) Temperature dependence of magnetic susceptibility [= $M(T)/B$] in CeCoSi (sample #1) for $B \parallel$ (a) [100] and (b) [001] below 20 K in magnetic fields up to 7 T. The data are shifted vertically for ease of viewing.

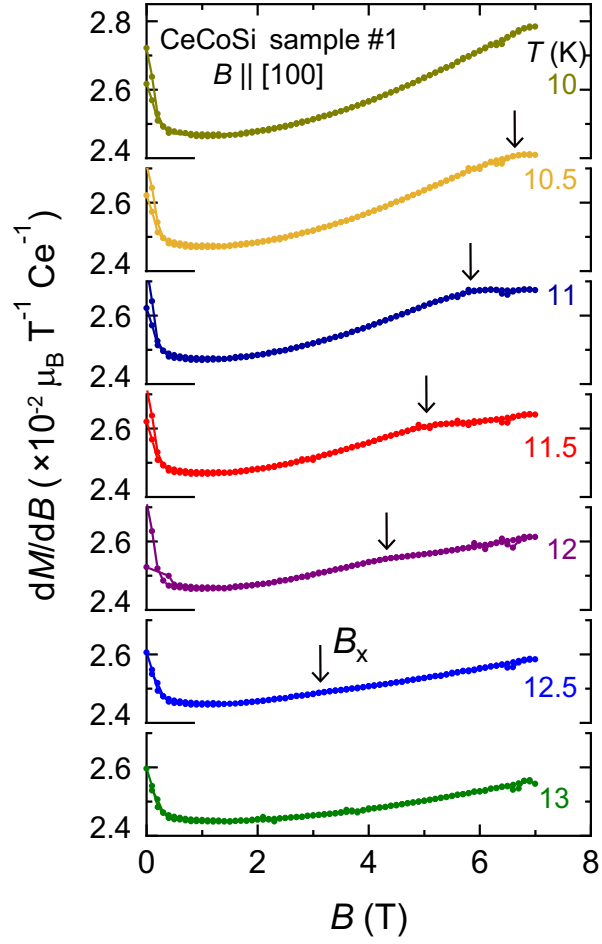


Fig. S3. (Color online) Magnetic field dependence of dM/dB in CeCoSi (sample #1) at several temperatures between T_N and T_0 for $B \parallel [100]$.

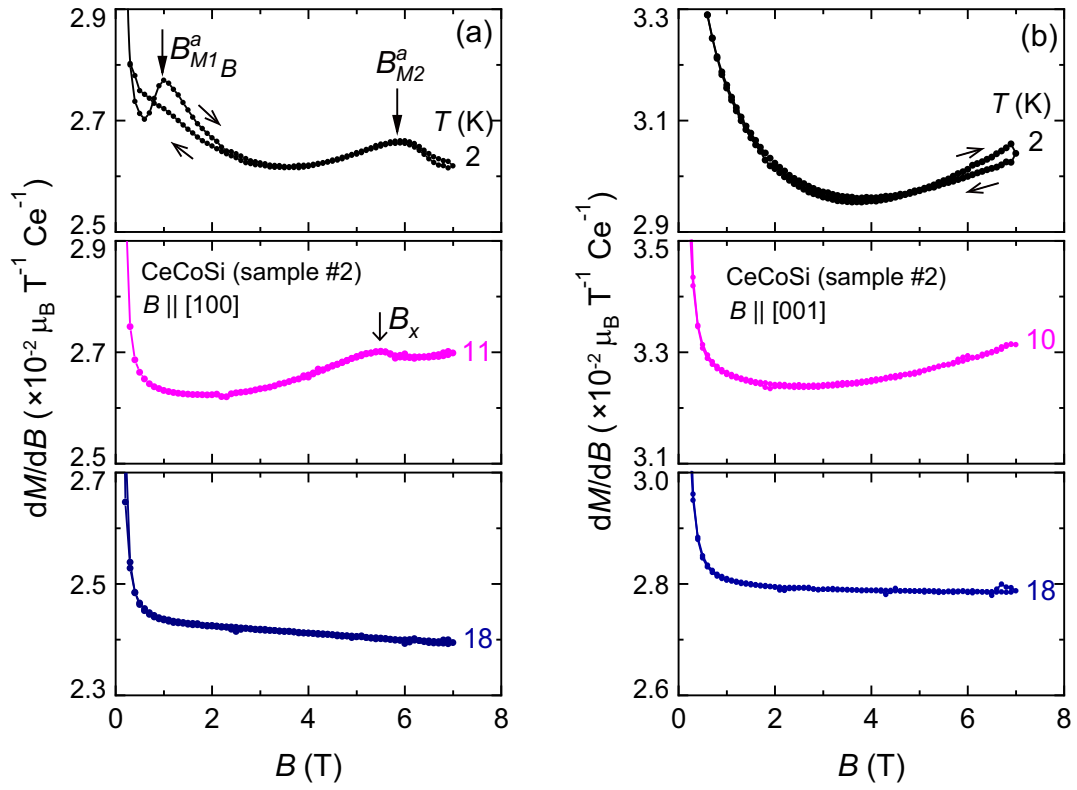


Fig. S4. (Color online) Magnetic field dependence of dM/dB in CeCoSi (sample #2) at several temperatures for $B \parallel$ (a) $[100]$ and (b) $[001]$. The black arrows near the hysteresis represent the B increasing and decreasing processes.

References

- [6] H. Tanida, K. Mitsumoto, Y. Muro, T. Fukuhara, Y. Kawamura, A. Kondo, K. Kindo, Y. Matsumoto, T. Namiki, T. Kuwai, and T. Matsumura, J. Phys. Soc. Jpn. **88**, 054716 (2019).