

## 微量鉍物の熱測定の高精度化・迅速化

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# 1986 Fiscal Year Final Research Report Summary

Accurate and rapid measurements of thermodynamic properties of minerals by microcalorimetric method.

Research Project

## Project/Area Number

60840023

## Research Category

Grant-in-Aid for Developmental Scientific Research

## Allocation Type

Single-year Grants

## Research Field

鉱物学(含岩石・鉱床学)

## Research Institution

Kanazawa University

## Principal Investigator

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## Project Period (FY)

1985 – 1986

## Keywords

Calorimetry / Heat capacity / Enthalpy / High pressure mineral / Rapid measurement / Accurate measurement / 迅速測定

## Research Abstract

1. Heat capacities of high-pressure silicate minerals were measured by the differential scanning calorimeter which was installed by the grant-in-aid for scientific research. The data processing system using the personal computer was made for rapid and accurate calculation of the heat capacity measured by the differential scanning calorimeter. Garnet solid solutions containing pyroxene components are stable in the pressure-temperature conditions in the mantle transition zone. Heat capacities of the garnet solid solutions in the system  $\langle \text{Mg}_4 \rangle \langle \text{Si}_4 \rangle \langle \text{O}_{(12)} \rangle - \langle \text{Mg}_3 \rangle \langle \text{Al}_2 \rangle \langle \text{Si}_3 \rangle \langle \text{O}_{(12)} \rangle$ , which represent the garnets in the transition zone, were measured by the present heat capacity measurement system. It was observed that heat capacity of the garnet solid solution at each temperature changed very little with increasing  $\langle \text{Mg}_4 \rangle \langle \text{Si}_4 \rangle \langle \text{O}_{(12)} \rangle$  component. The Gruneisen parameter and Debye

temperature of the garnet solid solutions were estimated from the heat capacity data.

2. Enthalpies of silicates and germanates stable at high pressures were measured. Enthalpies of transition of the silicates and germanates were obtained for the following systems:

(1) rhodonite-clinopyroxene-garnet transitions in  $\text{MnSi}_{<O_3>}$  , (2) wollastonite-garnet-perovskite transitions in  $\text{CaGe}_{<O_3>}$  , (3) pyroxenoid-garnet-ilmenite-perovskite transitions in  $\text{CdGe}_{<O_3>}$  , (4) pyroxene-garnet transition in the system  $\text{Mg}_4\text{Si}_4\text{O}_{12}$  -  $\text{Mg}_3\text{Al}_2\text{Si}_3\text{O}_{12}$  .

Phase boundaries for the above transitions were calculated from the measured enthalpies. They were almost consistent with the boundaries determined by the phase equilibrium experiments. It was established that the pyroxene(or pyroxenoid)- garnet transitions have generally gentle positive  $dP/dT$  slopes, while the ilmenite (or garnet)-perovskite transitions have negative slopes.

## Research Products (11 results)

	All	Other
	All	Publications (11 results)
[Publications] Ross,N.L.: Journal of Geophysical Research.91. 4685-4696 (1986)		▼
[Publications] Akaogi,M.: Physics and Chemistry of Minerals.13. 161-164 (1986)		▼
[Publications] Matsui,M.: Physics and Chemistry of Minerals.14. 101-106 (1987)		▼
[Publications] Akaogi,M: Physics and Chemistry of Minerals.(1987)		▼
[Publications] Akaogi,M edited by M.H.Manghnani;Y.Syono: High-Pressure Research in Mineral Physics,Terra Sci.Publ.(1987)		▼
[Publications] Akaogi,M.: Geophysical Research Letters.(1987)		▼
[Publications] Akaogi,M.: "Calorimetric study of high-pressure polymorphs of $\text{MnSi}_{<O_3>}$ ." Physics and Chemistry of Minerals.12. 317-323 (1985)		▼
[Publications] Ross,N.L.: "Phase transitions among the $\text{CaGe}_{<O_3>}$ polymorphs (wollastonite, garnet and perovskite structures) : studies by high-pressure synthesis, high-temperature calorimetry, and vibrational spectroscopy and calculation." Journal of Geophysical Research.91. 4685-4696 (1986)		▼
[Publications] Akaogi,M.: "Calorimetric study of high-pressure phase transitions among the $\text{CdGe}_{<O_3>}$ polymorphs (pyroxenoid, garnet, ilmenite and perovskite structures)" Physics and Chemistry of Minerals.(1987)		▼
[Publications] Akaogi,M.: "Pyroxene-garnet transformation: thermochemistry and elasticity of garnet solid solutions, and application to a pyrolite mantle." High-Pressure Research in Mineral Physics, edited by M.H.Manghnani and Y.Syono, Terra Sci. Publ.(1987)		▼
[Publications] Akaogi,M.: "High-temperature heat capacities of majorite garnet solid solutions in the system $\text{Mg}_4\text{Si}_4\text{O}_{12}$ - $\text{Al}_2\text{Si}_3\text{O}_{12}$ " . Geophysical Research Letters.(1987)		▼

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