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SUPERCONDUCTIVITY OF $Mo_3Al_2C$



Berkeley, California

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An investigation of ternary compounds of the form $M_3Al_2C$ (M = Mo, Nb, Ta, V, Ti or Cr) recently found by Jeitschko et al.,[1,2] has led to the discovery of a new superconductor, $Mo_3Al_2C$, which crystallizes in β-Mn (A13) structure.[1]

The samples, with the exception of $V_3Al_2C$, were prepared by hot-pressing the metal powders in graphite molds; $V_3Al_2C$ was made by arc-melting powder compacts in an argon atmosphere. In addition, sintered samples of $Nb_3Al_2C$ and $Ta_3Al_2C$ were prepared from powder compacts. All samples were annealed at 1000°C in vacuum and furnace cooled.

A superconducting transition was observed at 10.0°K for the compound $Mo_3Al_2C$. The lattice parameter for the β-Mn cubic cell was a = 6.867Å, which is in good agreement with the value reported by Jeitschko et al.[2] These investigators also found the β-Mn structure at the compositions $Nb_3Al_2C$ and $Ta_3Al_2C$, but reported that the phase crystallized with a second phase, the "H-phase," which has a hexagonal subcell. In the present investigation, only the H-phase could be identified in both hot-pressed and sintered samples; lattice parameters for the hexagonal subcell of the H-phase are shown in Table 1. Neither compound was superconducting above 4.2°K. Also, only the H-phases were observed for the compounds $V_3Al_2C$, $Ti_3Al_2C$ and $Cr_3Al_2C$ and no transitions were found for these compounds above 4.2°K. The lattice parameters for the hexagonal subcells of these compounds are also given in Table 1.

To our knowledge, this is the second compound of the β-Mn type found to show a superconducting transition, the first being $Nb_3Al_{0.5}Ge_{0.5}$,[3] which has a transition temperature of 12.6°K. The occurrence of superconductivity in both compounds at 10°K or higher indicates that the β-Mn structure is favorable for the occurrence of superconductivity at relatively high temperatures.

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Table 1

| Compound | H-Phase Lattice Parameters for Hexagonal Subcell |
|---|---|
| $Nb_3Al_2C$ | a = 2.67<br>c = 8.02 |
| $Ta_3Al_2C$ | a = 2.68<br>c = 7.97 |
| $V_3Al_2C$ | a = 2.52<br>c = 7.52 |
| $Ti_3Al_2C$ | a = 2.63<br>c = 7.87 |
| $Cr_3Al_2C$ | a = 2.47<br>c = 7.39 |

References:

(1) W. Jeitschko, H. Nowotny, and F. Benesovsky, Mh. Chem. 94, 247, 1963.

(2) W. Jeitschko, H. Nowotny, and F. Benesovsky, Mh. Chem. 94, 332, 1963.

(3) T. B. Reed, H. C. Gatos, W. J. La Fleur, and J. T. Roddy, Superconductors, Interscience Publishers, Inc., New York (1962), p. 143.