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SUPERCONDUCTIVITY OF Mo₃Al₂C

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March 1964

SUPERCONDUCTIVITY OF $\text{Mo}_3\text{Al}_2\text{C}$

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Berkeley, California

March 1964

An investigation of ternary compounds of the form $\text{M}_3\text{Al}_2\text{C}$ ($\text{M} = \text{Mo}, \text{Nb}, \text{Ta}, \text{V}, \text{Ti}$ or Cr) recently found by Jeitschko et al.,^(1,2) has led to the discovery of a new superconductor, $\text{Mo}_3\text{Al}_2\text{C}$, which crystallizes in $\beta\text{-Mn}$ (Al_3) structure.⁽¹⁾

The samples, with the exception of $\text{V}_3\text{Al}_2\text{C}$, were prepared by hot-pressing the metal powders in graphite molds; $\text{V}_3\text{Al}_2\text{C}$ was made by arc-melting powder compacts in an argon atmosphere. In addition, sintered samples of $\text{Nb}_3\text{Al}_2\text{C}$ and $\text{Ta}_3\text{Al}_2\text{C}$ 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 $\text{Mo}_3\text{Al}_2\text{C}$. The lattice parameter for the $\beta\text{-Mn}$ cubic cell was $a = 6.867\text{\AA}$, which is in good agreement with the value reported by Jeitschko et al.⁽²⁾ These investigators also found the $\beta\text{-Mn}$ structure at the compositions $\text{Nb}_3\text{Al}_2\text{C}$ and $\text{Ta}_3\text{Al}_2\text{C}$, 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 $\text{V}_3\text{Al}_2\text{C}$, $\text{Ti}_3\text{Al}_2\text{C}$ and $\text{Cr}_3\text{Al}_2\text{C}$ 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 $\text{Nb}_3\text{Al}_{0.5}\text{Ge}_{0.5}$ ⁽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.

We are grateful to Dr. Erwin Rudy of Aerojet-General Corporation, Sacramento, California for his assistance in making the hot-pressed samples.

Table 1

Compound	H-Phase Lattice Parameters for Hexagonal Subcell
$\text{Nb}_3\text{Al}_2\text{C}$	a = 2.67 c = 8.02
$\text{Ta}_3\text{Al}_2\text{C}$	a = 2.68 c = 7.97
$\text{V}_3\text{Al}_2\text{C}$	a = 2.52 c = 7.52
$\text{Ti}_3\text{Al}_2\text{C}$	a = 2.63 c = 7.87
$\text{Cr}_3\text{Al}_2\text{C}$	a = 2.47 c = 7.39

References:

- (1) W. Jeitschko, H. Nowotny, and F. Benesovsky, *Mh. Chem.* 94, 247, 1963.
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- (3) T. B. Reed, H. C. Gatos, W. J. La Fleur, and J. T. Roddy, Superconductors, Interscience Publishers, Inc., New York (1962), p. 143.

