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30 Jun 1975, Group 4, DoDD 5200.10; ONR ltr dtd 4 May 1977

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Project No. 54-1-0226

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Research Division  
NATIONAL RESEARCH CORPORATION  
70 Memorial Drive  
Cambridge 42, Massachusetts

Quarterly Letter Report  
April 1, 1963 - June 30, 1963

THERMODYNAMIC PROPERTIES  
OF  
BIMETALLIC COMPOUNDS (U)

Mr. Ludwig Fasolino  
E1. 4-5400 Ext. 320

DOWNGRADED AT 3 YEAR INTERVALS.  
DECLASSIFIED AFTER 12 YEARS  
DOD DIR 5200.10

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Contract Number: Nonr 3608(00)  
ARPA Order Number: 23-61  
Project Code Number: 3910  
Contract Date: 15 September 1961  
Expiration Date: 14 November 1963  
Contract Amount: \$188,819.00

Approved by: Allen L. Klibanoff  
Allen L. Klibanoff  
Program Director

Reviewed by: John V. E. Hansen  
John V. E. Hansen  
Contracts Manager  
Research Division

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## MAJOR ACCOMPLISHMENTS

(1) The heat of formation of lithium aluminum hydride was determined from heats of solution measurements. A special report was issued on April 26, 1963, covering the details of this work. The heat of formation was determined to be  $-26.63 \pm 0.31$  kcal/mole.

(2a) In preparation for determining the heats of formation of selected aluminum-boron compounds by fluorine combustion techniques, an apparatus was assembled for so doing. This included the construction of a manifold by which the combustion bomb will be charged and discharged.

(2b) The electrical calibration of the fluorine combustion calorimeter was completed. The heat capacity of the system was determined to be  $35.09 \pm 0.06$  cal/ohm at 25°C.

(3) The solution calorimeter was employed in an attempt to determine the heats of formation of the two aluminum hydrides Dowane-1451 and Olane-58. It was found that 4.0 N hydrochloric acid with chloroplatinic acid added as a catalyst was inadequate as a solvent for the materials at 25°C. Acceptable reaction rates were found at an acid concentration of 6.0 N and at a temperature of 75°C. The solution calorimeter was modified to operate adiabatically at this temperature. The precision with which the calorimeter operated at 75°C is comparable to that at 25°C.

A tantalum liner eliminated the undesirable side reaction of the bomb wall with the acid. The system was calibrated electrically and heats of solution of aluminum, Dowane-1451, and Olane-58 were measured. Several additional measurements are needed and are currently in progress. From these data, the heats of formation of Dowane-1451 and Olane-58 will be calculated.

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## PROBLEMS ENCOUNTERED

A delay in the acquisition of the fluorine gas prevented the commencement of the heats of combustion measurements of the aluminum-boron system. The aluminum hydride solution work was initiated during this delay time and is presently nearing completion. The fluorine has recently been received and the system is ready for use.

Measurement of the heat of formation of  $\text{Li}_2\text{AlH}_5$  has been delayed because Reaction Motors has not been able to supply a sample to National Research Corporation.

## ACTION REQUIRED BY ARPA

None

## FUTURE PLANS

Dr. Perry of Reaction Motors has informed me of the successful synthesis of  $\text{Li}_2\text{AlH}_5$ . He will attempt to forward a sample to me by July 8, 1963. Upon receipt of this material, heats of solution will be carried out from which its heat of formation may be calculated. The auxiliary data required will be that previously generated in this laboratory in the same calorimeter to be employed for the  $\text{LiAlH}_4$  work.

4

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