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Project No. 54-1-0226

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

Quarterly Letter Report  
July 1, 1963 - September 30, 1963  
THERMODYNAMIC PROPERTIES  
OF  
BIMETALLIC COMPOUNDS (U)

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

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

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Submitted to:

Advanced Research Projects Agency  
The Pentagon, Room 3D-159  
Washington 25, D. C.  
Attn: Advanced Propellant  
Chemistry Office

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

Approved by:

*Allen L. Klibanof*  
Allen L. Klibanof  
Program Director

Reviewed by:

*Frank J. Salomone*  
Frank J. Salomone  
Contracts Manager

September 27, 1963

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- 1 -

## MAJOR ACCOMPLISHMENTS

### I Heat of Formation of Aluminum Hydride (Olane-58)

The heat of formation of Olane-58 was determined by measuring the heats of solution of aluminum and Olane-58 in 6N HCl at 75°C. To accomplish this elevated temperature calorimetry, the apparatus was modified. By correcting the data to 25°C, the heat of formation of Olane-58 was found to be  $-4.6 \pm 1.6$  kcal/mole.

### II Heat of Formation of Aluminum Hydride (Dowane-1451)

The heat of formation of Dowane-1451 was determined by measuring the heats of solution of aluminum and Dowane-1451 in 6N HCl at 75°C. Correcting to 25°C, the heat of formation of Dowane-1451 was found to be  $-2.5 \pm 3.7$  kcal/mole.

A special report covering the details of the above work (I, II) was issued on August 1, 1963.

### III Heat of Formation of Reaction Motors Material, $\text{Li}_3\text{AlH}_6$

A sample of material, believed to be  $\text{Li}_3\text{AlH}_6$  was

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- 2 -

received from Reaction Motors. Ten measurements of the heat of solution in 4.0 N HCl were made at 25°C. Utilizing this data along with the heats of solution of lithium and aluminum (previously determined in this laboratory), the heat of formation of  $\text{Li}_3\text{AlH}_6$  was calculated.

To determine the purity of the material, it was analysed for Al, Li, H, and Cl. From this analysis, the material was found to be 92.87%  $\text{Li}_3\text{AlH}_6$ . An X-ray diffraction pattern was also made of this material.

The heat of formation was determined to be  $-79.39 \pm 3.45$  kcal/mole of 100% pure material. The details of this work are currently being written up in a special report.

## IV Fluorine Combustion Calorimetry

In preparation for determining the heats of fluorination of selected materials, the fluorine handling manifold has been passivated by subjection to fluorine gas at pressures up to 160 psig. The combustion bomb was passivated at 160 psig of fluorine at temperatures up to 100°C.

## PROBLEMS ENCOUNTERED

None

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- 3 -

**ACTION REQUIRED BY ARPA**

None

**FUTURE PLANS**

With the passivation of the fluorine combustion apparatus complete, the immediate plans are to commence with the combustion of boron in fluorine, as the first phase of determining the heat of formation of aluminum diboride,  $\text{AlB}_2$ .

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