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Compounds - Dehydration
Compounds - Thermochemical properties
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DIFFERENTIAL THERMAL ANALYSES OF SOME METAL HYDROXIDES

Dorothy P. Enright

In view of the interesting effects observed concerning the change in friction between the particles of dry powders on heating[1], a further study of the effects of dehydration of materials was made.

The energy changes which accompany the dehydration of materials can be studied by means of differential thermal analysis. The equipment used for this study was similar to that described by R. M. Gruver[2]. The rate of heating and temperature of the furnace were controlled automatically. The e.m.f. measured by the differential thermocouple was also automatically recorded. The heating rate of the furnace was 600°C per hour for most of the analyses. However, in the analyses of Mg, Ca, Sr, Zn, and Cd hydroxides a heating rate of 400° C was used. The reference material for all analyses was sintered Al_2O_3 (C.P., Eimer and Amend).

The metal hydroxides were prepared as follows: $Ca(OH)_2$ was obtained by the hydration of CaO; $Si(OH)_4$, by the hydrolysis of ethyl

DEHYDRATION OF HYDROXIDES

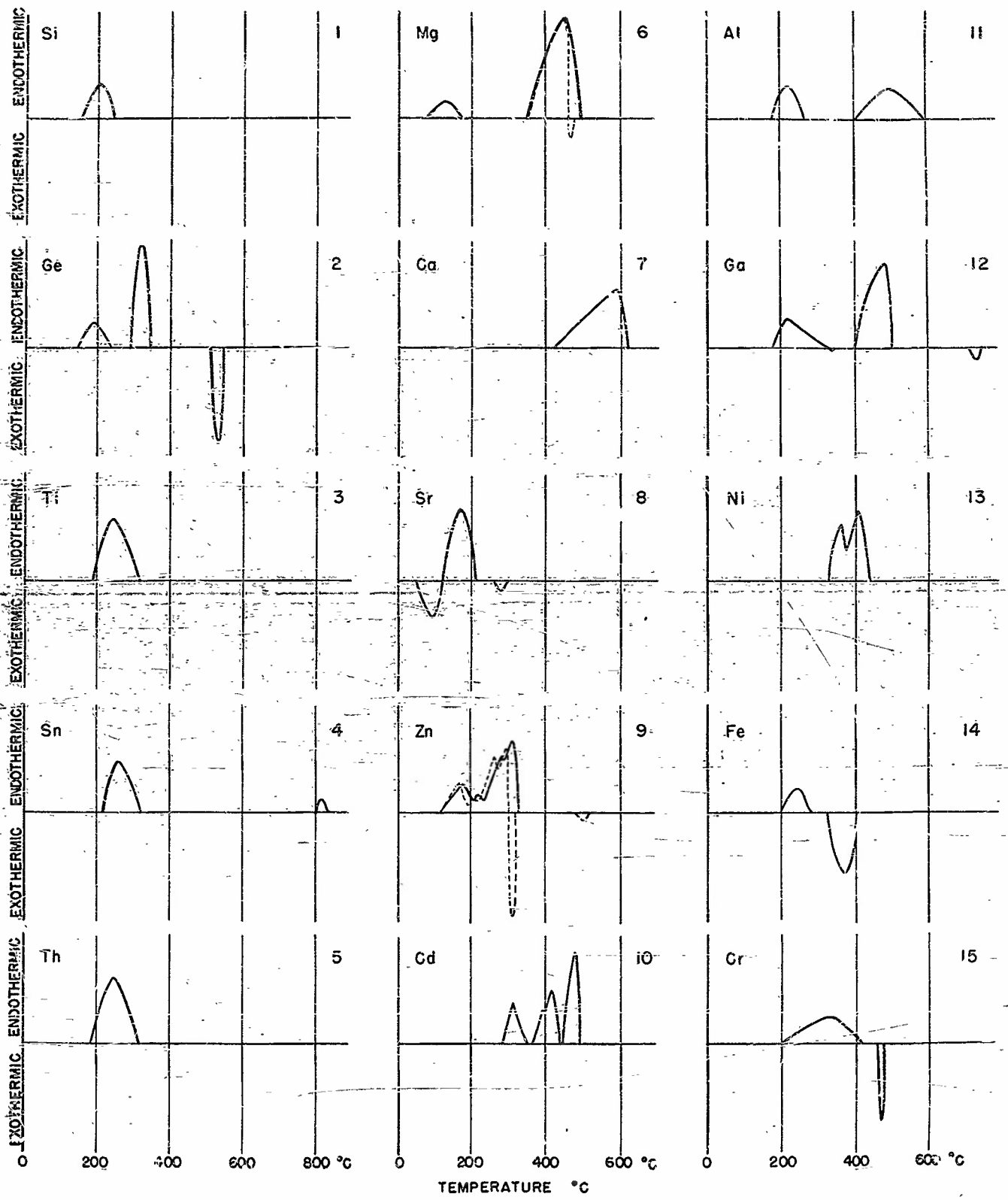

FIGURE 1

orthosilicate; and $Ge(OH)_4$, by acidifying a sodium germanate solution with dilute HCl and then electrodialyzing the gel thus formed. The hydroxides of Mg, Al, Ga, Cr, and Fe were precipitated by NH_4OH from their nitrate salt solutions; the hydroxides of Zn, Sr, Cd, Ni, and Th, by NaOH from their nitrate salt solutions; and the hydroxides of Ti and Sn, by NaOH from their chloride salt solutions.

The data obtained for fifteen metal hydroxides are presented in Figure 1. The endothermic and exothermic heat effects are plotted as a function of the temperature at which they occur.

Since the series, Mg, Ca, Sr, and Zn hydroxides (Graphs 6-9, Figure 1) showed from 1 to 4 distinct endothermic peaks plus two exothermic effects ($Sr(OH)_2$) when heated in air, this group was chosen for further study. Differential thermal analyses of these hydroxides were made also in a hydrogen atmosphere.

The differential thermal analysis curves of $Ca(OH)_2$ and $Sr(OH)_2$ in hydrogen are identical with those obtained in air and are not included on the graphs given in Figure 1.

However, with $Mg(OH)_2$, in addition to the two endothermic effects observed when heated in air, one exothermic peak was also produced (Graph 6, Fig. 1). In like fashion, $Zn(OH)_2$ showed two additional exothermic heat effects when heated in a hydrogen atmosphere (Graph 9, Fig. 1).

1. A. C. Marshall and P. A. Marshall, Jr. Technical Report No. 40 Office of Naval Research, Contract N6 onr 269 Task Order 8, NR 032-264 and 265, The Pennsylvania State College, April 1952

2. R. M. Gruver. Jour. Am. Ceramic Soc. 31 (12) 223-228 (1948)