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# Kinetics of Thermal Decomposition of $Cd(OH)_2$ Powders

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Recently, Sävborg *et al.* (*1*) presented a report on the application of time resolved X-ray diffraction (TRXD) by synchrotron radiation to thermal decomposition of $Cd(OH)_2$. The $Cd(OH)_2$ powder was prepared by slow mixing of hot 0.5 *M* $Cd(NO_3)_2$ and decarbonated 0.5 *M* KOH solutions.

The reported results of the kinetics of thermal decomposition of $Cd(OH)_2$ by two methods, thermo-gravimetric analysis (TGA) and TRXD, showed the water loss and the formation of the oxide "not be concomitant temporally, kinetically, or mechanistically" (*1*). A number of effects, surface energy effects by adsorbed water, thermal disruption of the lattice, and the role of unspecified defects are speculated to be responsible for the inconsistent decomposition kinetics results.

Feitknecht (*2*) reported the coprecipitation of basic salts with hydroxides when the precipitation is carried out by the addition of NaOH to cadmium salt solutions. The presence of basic salts in solid solution or coprecipitated with $Cd(OH)_2$ has led to a number of conflicting reports (*3–7*) on the physicochemical properties of "pure" $Cd(OH)_2$. It was subsequently confirmed by infrared spectroscopy, differential thermal analysis, and TGA that $Cd(OH)NO_3$ and $Cd_2(OH)_3NO_3$ can be coprecipitated with $Cd(OH)_2$ when prepared by the reaction of alkali and cadmium nitrate solution (*8*).

Thermal analyses and kinetics of thermal decomposition of a number of metal hydroxycompounds including $Cd(OH)_2$ and its derivatives have been reported in detail (*5, 9*). The kinetics of thermal decomposition of spectroscopically and TGA "pure" $Cd(OH)_2$ was observed to obey the simple first-order rate equation, that is, for $n = 1$ in the Erofeev equation,

$$\alpha = 1 - \exp(-kt^n), \qquad (1)$$

indicating the absence of a nucleation-controlled mechanism. This behavior is at variance with the diffusion-controlled kinetics reported (*1*).

The above facts from independent studies suggest quite strongly that the inconsistent decomposition kinetics data reported by Sävborg *et al.* (*1*) reside in the presence of the basic salt $Cd(OH)NO_3$ as impurity in $Cd(OH)_2$. Such an impurity could account for the overall inconsistencies observed, viz. decomposition always less than 100%, role of impurity as defects on crystallization processes, etc.

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