Journal of Thermal Analysis, Vol. 5 (1973) 501—502

A REPLY TO "ON THE METHOD OF COATS AND REDFERN FOR KINETIC ANALYSIS OF THERMOANALYTICAL DATA by T. OZAWA"

M. D. JUDD and M. I. POPE

Department of Chemistry, Portsmouth Polytechnic, Portsmouth, U.K.

(Received September 10, 1972)

Ozawa [1] has pointed out that one of the equations included in our paper on the thermal decomposition of the alkaline earth carbonates [2] is incorrect, namely that

$$\log\left[-\log\frac{(1-\alpha)}{T^2}\right] = \log\frac{AR}{aE}\left[1-\frac{2RT}{E}\right] - \frac{E}{2.303RT} \tag{1}$$

should be replaced by

$$\log\left[-\ln\frac{(1-\alpha)}{T^2}\right] = \log\frac{AR}{aE}\left[1-\frac{2RT}{E}\right] - \frac{E}{2.303RT} \tag{2}$$

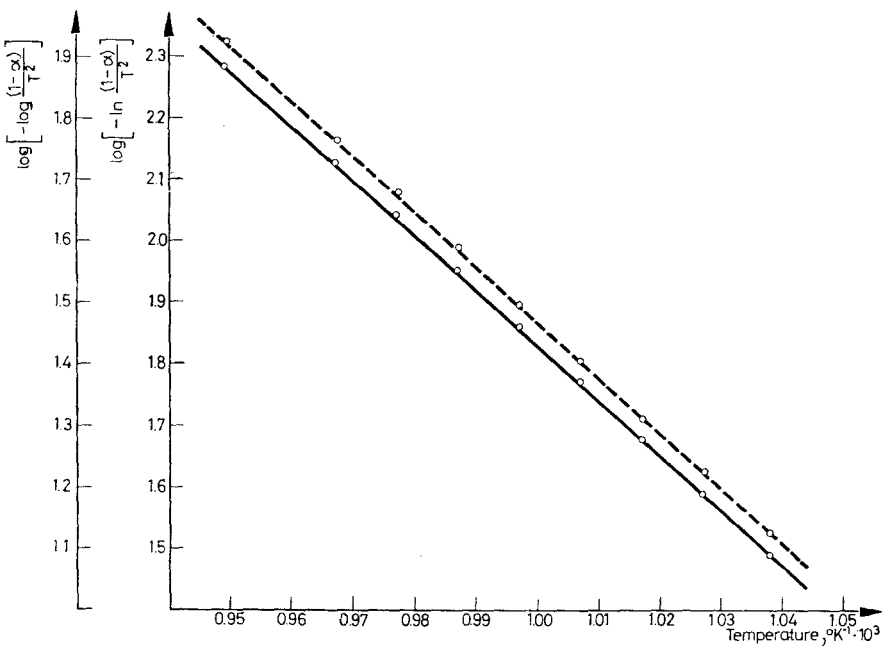

Fig. 1. Activation energy plot for some test data where $n = 1$

However, the use of Eq. (2), instead of Eq. (1) (even though incorrect) introduces negligible error in calculation, any error being effectively eliminated by the use of a log log plot. This is demonstrated in the figure. The solid line represents a simulated activation energy plot, using Eq. (2), for some test data, calculated such that n, the order of reaction, should have a value of unity. The broken line is a similar plot for the same α, T data using Eq. (1). In both cases, a value for the slope of -8.95×10^3 min^{-1} is obtained.

A further comment is then made, in connection with our own results, that "revision would become necessary, since the incorrect method is applied to analyse the experimental data". It was made clear in both the original paper by Coats and Redfern [3] and in our own report, that the equation above only applies in the case where $n = 1$. For the general case where $n \neq 1$, the correct expression is

$$\log \frac{1 - (1 - \alpha)^{1-n}}{T^2(1 - n)} = \log \frac{AR}{aE}\left[1 - \frac{2RT}{E}\right] - \frac{E}{2.303\,RT} \qquad (3)$$

Our data was calculated, using values for n of 1/2 and 2/3, using Eq. (3), and therefore no revision is necessary since the correction to the equation for $n = 1$ does not affect the treatment of our results.

References

1. T. OZAWA, J. Thermal Anal., 5 (1973) 499.
2. M. D. JUDD and M. I. POPE, J. Thermal Anal., 4 (1972) 31.
3. A. W. COATS and J. P. REDFERN, Nature, 201 (1964) 68.