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THERMOGRAVIMETRIC ANALYSIS OF LANTHANIDE ALKANOATES

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ABSTRACT

The thermogravimetric results reveal that the thermal decomposition oflanthanide octanoatesi.e, lanthanum, cerium, praseodymium and neodymiumoctanoates, iş kineticallyof zero order with energy of activation lying between 7-9K.Cal mole-1.

Keywords: Lanthanide Octanoate, Energy of activation, thermaldecomposition, order of reaction.

INTRODUCTION

The study of lanthanide Octanoates is becoming increasingly important intechnological as well as in academic fields. It has been a subject of intenseinvestigations in the recent past on account of its role in such diversified fields asdetergents, softners, stablizers, catalysts, anti-oxidants lubricants, emulsifiers,water proofing and wetting agents. Nevertheless the studies on these octanoates arelimited, with the result that only few references [1-10] are available.

Now-a-days metal Octanoates have widely been used as a thermal stabilizers in different industries in China and Japan [11-14]so the present paper includesthermal analysis of lanthanide Octanoates. The results of thermogravimetricanalysis have been used to determine the order of reaction and energy ofactivation for the decomposition reaction.

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EXPERIMENTAL

Lanthanum nitrate, cerium chloride, praseodymium nitrate and neodymiumnitrate (Indian rare earths Ltd) and Octanoic acid (BDH) were used for the preparation of lanthanide octanoate. The lanthanum, cerium, prascodymium andneodymium octanoates were prepared by direct metathesis of the correspondingpotassium Octanoate with the required amount of lanthanum nitrate, ceriumchloride, prascodymium nitrate and neodymium nitrate splutions at 50-60°C undervigorous stirring. The precipitated octanoates were filtered and washed withdistilled water and alcohol and recrystallized with a mixture of benzene andmethanol and dried under reduced pressure.

The thermogravimetric analysis of lanthanum, cerium, praseodymium andneodymium octanoates were carried out by a Perkin-Elmerthermo gravimetricanalyzer (TG-S-2) in nitrogen atmosphere at a constant heating rate of 10^{o}/minutemaintaining similar conditions throughout the experiments.

RESULT AND DISCUSSION

The results of the thermogravimetric analysis of lanthanum, cerium.praseodymium and neodymium Octanoate are given in Table 1. It is found that thefinal residue is metal oxide and the weights of the residue are in agreement withthe theoretically calculated weight of lanthanum oxide, cerium oxide,praseodymium oxide and neodymium oxide from the molecular formulae of thecorresponding Octanoates. A white substance is found deposited at the cold part ofthe sample tube surrounding the sample and it is identified as Octanone(mp 39°C)

The termal decomposition of these Octanoates can be expressed as

$$2(C_7H_{15}C00)_3M \rightarrow \quad 3(C_7H_{15})_2\,CO + \quad M_2O_3 \quad + 3CO_2$$

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Meta octanoate (soap) octanone (ketone) Metaloxide (residue) Carbon dioxide (gas)

Where M stands for La, Ce, Pr and Nd,respectively.The theromogravimetricdata were used to calculate the energy of activation and to find the order ofreaction for the decomposition of lanthanum, cerium, praseodymium andneodymium Octanoates using the equations of Freemann and Carroll [15] which maybe written as

$$\frac{\Delta \log \left(\frac{dw}{dt}\right)}{\Delta(\log W_r)} = -\frac{E}{2.303R} \cdot \frac{\Delta(1/T)}{\Delta(\log W_r)} + n$$

E= Energy of activation

R= Gas Constant

N= Order of decomposition reaction

T= Temperature on absolute scale

W= Difference between the total loss in weight and the loss in weight at time t.i.e. Wo-Wt.

and $\frac{(dw)}{(dt)}$=Rate of weight loss obtained from the loss in weight vs time curves at appropriate times. The plots of the loss in weight of the soap, w against t-time, t are shown in Fig. 1 and the values of dw/dt are obtained from these curves by drawing tangents at appropriate time.

The plots of $\Delta \log \frac{(dw)}{(dt)}$ / Δ (log Wr) vs Δ1 /T/D logwr have been found be linear

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with intercept equal to zero (Fig 2) It is, therefore, concluded that the order ofreaction for the decomposition of litiumideoctanoates is zero and the values ofenergy of activation from the stope (-E/2.303R) of the p;ots (Fig.2) are 7.7, 7.8, 9.2 and 7.9 Kcal mole-1 for lanthanum, cerium, praseodymium and neodymiumOctancates respectively.

The aforesaid fact that the process of decomposition of metallic alkanoates is kinetically of zero order, is in harmony with the fact that the surface of the soap molecules remains completely covered all the time by the molecules of the gaseous product and so the decomposition is fast and the rate of decomposition becomes constant.

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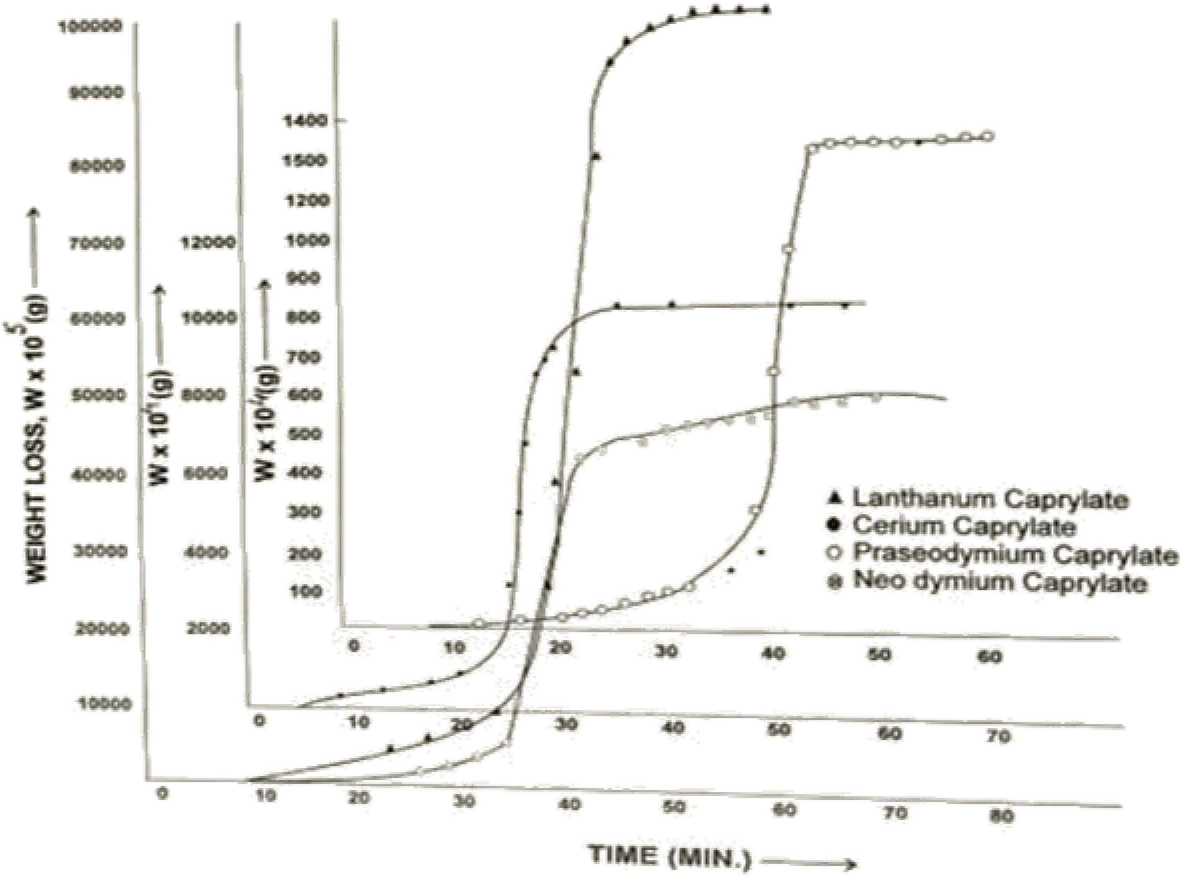
Fig 1 THERMO-GRAMS OF CAPRYLATES OF LANTHANIDE SOAPS



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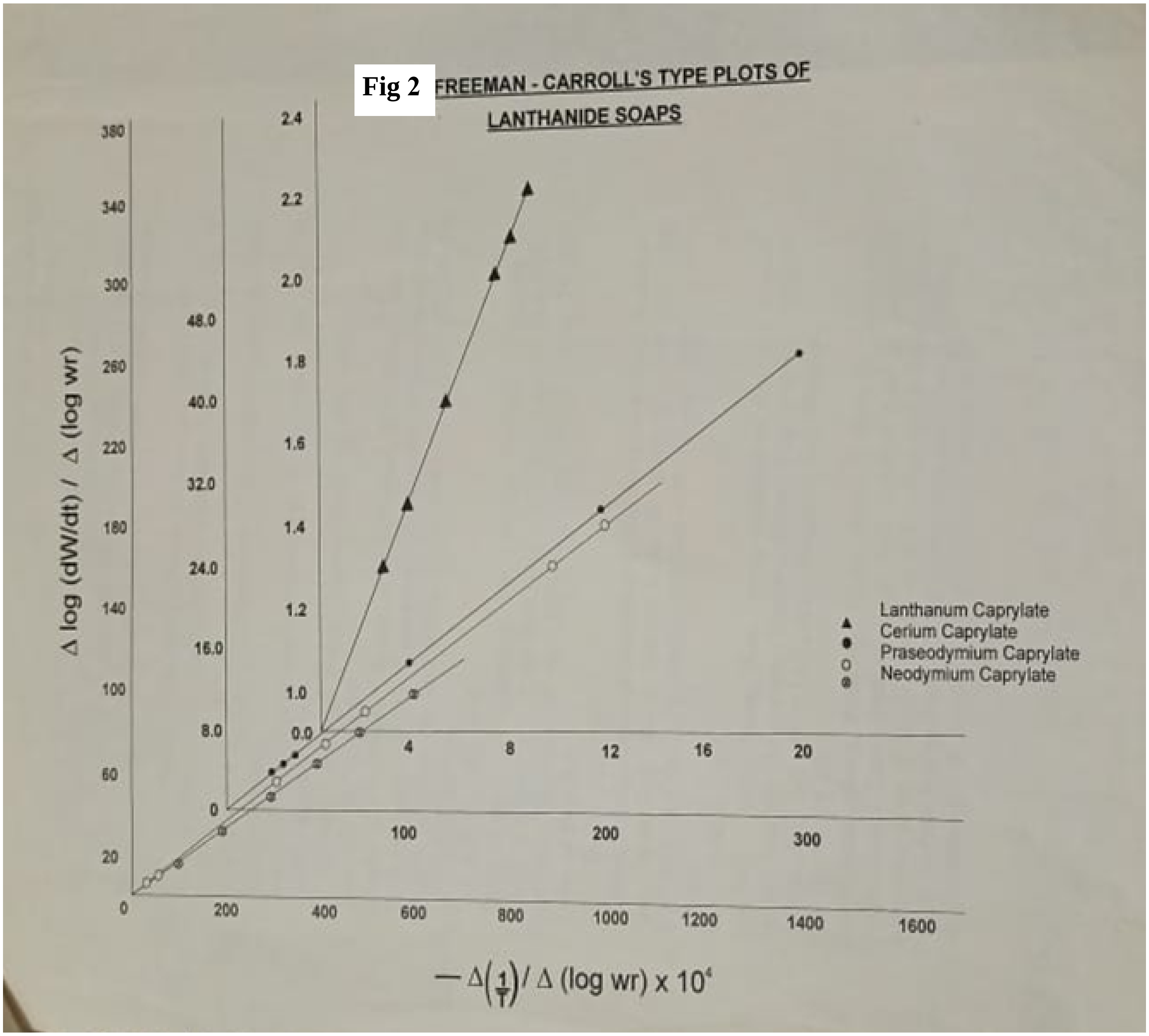

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REFERENCES

Journals

1. R.W. Rilling and J.E. Roberts, Thermochim. Acta, 10, 285 (1974)
2. B. Lorant, SeifenOcclette-Wachse., 93 (16_,547 (1967)
3. AK. Solanki and A.M. Bhandari, Tenside Detergents, 184 (1) 34 (1981)
4. K.N. Mehrotra, M.Saxena and A. Kumar, An. Asos. QuimArgentina 78(5) 319 (1990)
5. K.N. Mehrotra, S.K. Upadhyaya, Polish, J.Chem.,65 1035 (1991)
6. K.N. Mehrotra, R.K. Shukla and M. Chauhan, Tenside Yurt, Det. 34(1997) 2.
7. K.Smarti, S. Verghese, L. Chandreshwar (Agra, India) TensideSurf Det.40(2), 108 (2003)
8. R.K. Shukla,& S.Upadhyaya and G Sharma, J. Ind. Chem. Soe, 84, 149
9. R. Bacologlu, M. Fisch, Polym. DegradStabl., 45, 310 (1993)
10. Vol. 137, No – 15, 2002

    Fouda, M.F.R.; Yousef, Elham A.A, Mohamed, S.S., Shoeb, IateZeinE. (Inorganic Chemistry Department, National Research Centre, Cairo, Egypt).GarasasyAccites (Sevilla, Spain) 2001, 52 (5), 317-322 (Eng.)Institute de la Grasa.

Reports:

11. Vol 143, No.-24, 2005

    Duan, Xue; Li, Dianging, Lin, Yanjun (Beijing University ofChemical Technology, Peop, Rep. China) PCT Int. Appl WO 2005 105, 909 (Cl. CO8K3/26), 10 Nov 2005, CN Appl. 10, 037, 656, 29 Apr.2004, 14 PP (Ch.)

12. Vol. 139, No-21, 2003

    Wakaki, Seize; Tanaka,Yoshitaka (MizerSatva Industrial Chemicals,Ltd., Japan) Jpn,KokaiTokkyoKoho JP 2003 301, 119 (Cl. CO8 L101/04), 21 Oct, 2003, Appl. 2002/109, 679, 11 Apr 2012; 16 PP;(Japan)

13. Vol. 136 No.4 2002

Lin, Mei-Juan; Zhang, Wen-gong (Institute of Polymer Science,Fujian Teachers University, Fuzhou, Peop. Rep. China. 350007).HuagongKeji 2001, 9(1), 19-22 (Ch.), HuagongKejiBianjibu.

14. Vol. 136 No-12,2002

Lin, Meijuan; Zhang, Wengong; Huang, Xiamon (Instt. Polymer; Sci., Fujjin Normal Univ., Fuzhou, Peop, Rep. China) XiandalSuliaoJi-agongyingyong 2001, 13 (4), 43-45 (Ch), ZhongguiShihuaJituanGongsiXiandaiSuliaoJiagong Ying Young OingbaoZhongxinhan.

15. Patents E.S. Freemann and B. Carroll: J phys. Chem. 62 394 (1958)

Books

16. Vogel's "Text book of Quantitative ChemicalAnalysis" Revised by G.H. JEFFERY, J. BASSETT, J. MENDHAM and R.C. DENNEY LONDON 1991.

17. A Text Book of Physical Chemistry "second Edition

GLASSTONE.