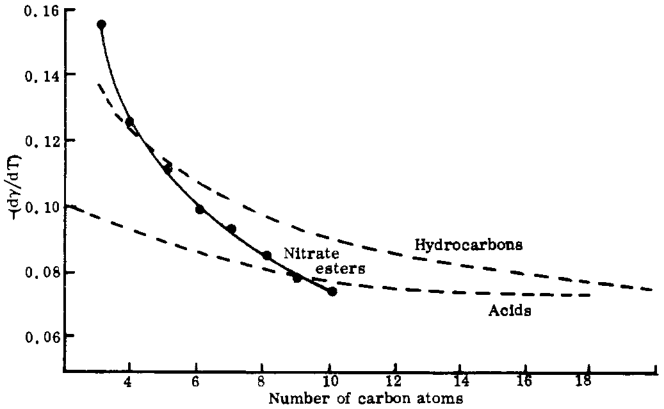

Figure 2. $-(d\gamma/dT)$ of α,ω-alkane nitrate esters as a function of the chain length compared to *n*-paraffins and carboxylic acids (*1*)

and the average deviation of the measured values was ±0.15 dyne per cm.

The corrective term *A* varied somewhat with the bursting pressure, but this has been accounted for by calibration curves of known materials. A few compounds of known surface tensions which were measured with this apparatus over the range of temperature encountered in this investigation are listed as follows:

	Water				Benzene	
T, ° C.	20	30	40	50	25	40
γ, dynes per cm.	72.8	71.1	69.6	67.9	28.4	26.4
γ, dynes per cm. (*5*)	72.75	71.18	69.56	67.91	28.35	26.30

The surface tensions of the nitrate esters were measured at the following temperatures: 0°, 10°, 25°, 35°, and 45° C. The reported data are the averages of 15 measurements.

RESULTS

The densities and molar volumes of the α,ω-dinitroxy alkanes from ethane to decane as a function of temperature and carbon atom numbers (n) are listed in Table I. The surface thermodynamic quantities are given in Table II. These values were calculated from the surface tension and its temperature dependence (*4*). The surface energy remained constant within the experimental error over the measured temperature range, and it decreased with increasing chain length. The values of the surface tension alternate slightly as n changes between odd and even values. The alternation of the surface tension caused by the change of n decreased when the temperature increased from 0° to 45° C.

In Figure 2, the temperature coefficient ($-d\gamma/dT$, entropy) of the surface tension for each compound of the homologous series is given as a function of n. The slope $-d\gamma/dT$ for each compound was determined by the method of least squares. The temperature coefficient $-d\gamma/dT$ has high values for the shorter chain compounds and falls gradually as the n increases. The limiting value for the hydrocarbons and acids, which is about 0.07, (*1*), seems to be reached gradually also by this homologous series. In all three series (acids, hydrocarbons, and nitrate esters), the limiting value is practically reached when the chains are about 10 carbon atoms long.

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Specific Conductance of Aqueous Sodium Chromate at 25° C.

WALTER R. KELLY and THOMAS R. MORGAN
Solvay Process Division, Allied Chemical Corp., Syracuse, N. Y.

THE CONDUCTANCES of comparatively dilute aqueous solutions of sodium chromate have been measured by Watkins and Jones (*5*), Heydweiller (*3*, p. 251), and Clausen (*3*, p. 251).

This present work extends the conductance data to aqueous sodium chromate solutions of concentrations ranging from 5% to near saturation, and it was done in answer to questions on the instrumental control of concentration. Although this information was obtained on a weight basis, density measurements at 25.0° C. were made to permit values to be interpreted on a volume basis.

PREPARATION OF CHROMATE SOLUTIONS

The sodium chromate solutions were prepared by accurately weighing quantities of purposely analyzed, reagent grade $Na_2CrO_4 \cdot 4H_2O$, and deionized water, to give nine

The specific electrolytic conductances of aqueous sodium chromate solutions, ranging in concentration from 5 to about 45% Na_2CrO_4—i.e., to near saturation—were measured at 25.0° C. The specific conductance reaches a maximum of 0.146 ohm^{-1} $cm.^{-1}$ at 28% Na_2CrO_4. The densities of these solutions at 25.0° C. were also determined.

Table I. Specific Conductances of Aqueous Sodium Chromate Solutions at 25° C.

Na_2CrO_4, % by Weight	Density, Grams per Ml.	Specific Conductance, Ohm^{-1} $Cm.^{-1}$
5.08	1.043	0.048
10.15	1.091	0.087
15.24	1.141	0.112
20.29	1.195	0.132
25.38	1.252	0.143
30.46	1.311	0.145
35.56	1.375	0.138
40.68	1.443	0.117
44.46	1.495	0.101

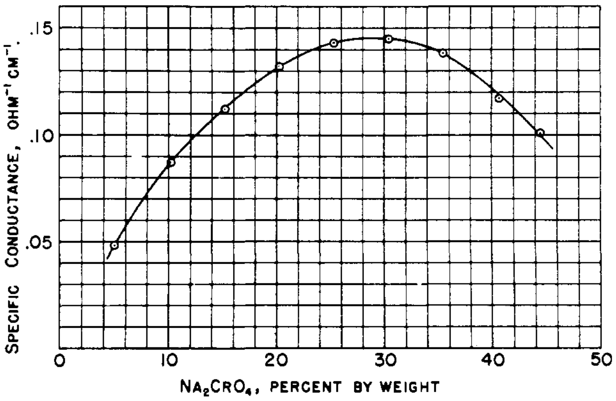

Figure 1. Specific electrolytic conductances of aqueous sodium chromate solutions at 25° C. *vs.* % Na_2CrO_4 by weight

solutions ranging in approximate 5% intervals from 5 to 44.5% Na_2CrO_4 by weight and totaling 500.000 grams each.

The reagent grade $Na_2CrO_4 \cdot 4H_2O$ with only minor impurities assayed 70.27% Na_2CrO_4 as determined by the analysis for hexavalent chromium described below. The deionized water was of high purity, as indicated by its specific conductance of 0.52 × 10^{-6} ohm^{-1} $cm.^{-1}$ at 25° C.

HEXAVALENT CHROMIUM ANALYSIS

Samples were analyzed by potentiometric titration with ferrous sulfate solution containing added sulfuric acid. The ferrous sulfate was standardized at the time of analysis with six weighed samples of National Bureau of Standards $K_2Cr_2O_7$ (99.98%). Calibrated weights, reagent grade chemicals, and volumetric glassware stamped with the approval of the National Bureau of Standards were used throughout.

The standard deviation of the values of concentrations prepared from the Na_2CrO_4 on a weight basis from those obtained on the same solutions by potentiometric analysis was 0.1%.

DENSITIES OF CHROMATE SOLUTIONS

The densities of the chromate solutions at 25° C. were determined by a pycnometer equipped with a 0° to 40° C. thermometer, graduated in 0.2° divisions. The volume of the pycnometer was determined at 25.0° C. using boiled deionized water.

Densities agree with those estimated from the data of Hartford (*2*) at 15.6° C. and Kearley (*4*) at 25° C. within a standard deviation of 0.2%.

MEASUREMENT OF CONDUCTANCE

The specific conductances of the several sodium chromate solutions at 25.0° C. were carried out with a Serfass conductivity bridge (Model RCM-15, Arthur H. Thomas Co.) and a dipping-type conductivity cell (No. 3995, K = 1.00, Industrial Instruments, Inc.) having platinized electrodes. The bridge and cell were standardized against normal KCl, 0.1*N* KCl, and saturated NaCl, all at 25.0° C. Specific conductances of these standards in ohm^{-1} $cm.^{-1}$ were 0.1118 (*3*, p. 230), 0.01288 (*3*, p. 230), and 0.2513 (*1*), respectively.

The instrumental standard deviation of several measurements on reference solutions was 1%. The crystalline KCl used was special reagent grade, suited to the preparation of calomel electrodes. Moisture content of 0.02% was taken into account. The crystalline NaCl was reagent grade, meeting ACS specifications.

RESULTS

The specific conductances and densities of the various analyzed concentrations of aqueous sodium chromate at 25.0° C. are given in Table I. Figure 1 shows the specific conductances in ohm^{-1} $cm.^{-1}$ plotted against concentrations of chromate expressed as Na_2CrO_4, per cent by weight. The specific conductance reaches a maximum of 0.146 ohm^{-1} $cm.^{-1}$ at 28% Na_2CrO_4.

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