The mixture is shaken vigorously for at least ten hours. For 5 kg. of mercury a 5-liter heavy-walled bottle connected with an air condenser (the heat of the reaction is small) was used. The contents of the bottle were transferred to a separatory funnel with the aid of water, the lowest layer consisting of mercury withdrawn, and then the gray precipitate (oil emulsified with mercury), the water and oil remaining in the funnel. The precipitate was steam distilled and the resulting oil united with the portion in the separatory funnel. After washing with dilute sodium hydroxide, water, and drying with calcium chloride, the oil was fractionally distilled under diminished pressure, b. p. 85° at 11 mm.

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COMMUNICATIONS TO THE EDITOR

LOCATION OF ACTIVITY IN MIXED CATALYSTS

Sir:

We have investigated the case where each component of a mixed catalyst promotes its proper reaction, acting on a single substance; from the standpoint of the multiplet theory this is effected as a result of specific orientation. The catalysts used were of the Zelinsky and Kommarewsky type [*Ber.*, **57**, 668 (1924)], Ni:Al_2O_3 = 1:1, prepared in different conditions of precipitation from nitrates, sulfates and chlorides. The parallel dehydrogenation and dehydration of isoamyl alcohol, together with carbon monoxide elimination from valeraldehyde formed, were kinetically studied in an apparatus described previously [Balandin, *Z. physik. Chem.*, **B19**, 453 (1932)]. A complete analysis of the gases evolved was made. The data fitted the Arrhenius equation. With different preparations of the catalyst the energies of activation Q varied in the range from 8850 to 22,400, from 17,950 to 45,100 and from 14,500 to 33,100 cal./mole for the dehydrogenation, dehydration and the aldehyde decomposition processes, respectively. The ratio of Q's for different processes with the same catalyst preparation was determined. It is most remarkable that for different preparations this ratio remains constant within experimental errors.

Catalyst No.	1	2	5	6	7	8	Av.
Q_{H_2}/Q_{H_2O}	(0.32)	0.50	0.61	0.50	0.59	0.57	0.51
Q_{H_2}/Q_{CO}	.62	.67	.64	.59	.71	.90	.69
Q_{H_2O}/Q_{CO}	1.20	1.36	1.05	1.20	1.20	1.58	1.26

The logarithmic relation between k_0 and Q in $k = k_0 \exp(-Q/RT)$, found previously [Balandin, *loc. cit.*] for catalytic dehydrogenation processes, holds true with practically the same coefficient $Q/\log k_0$ as before. The same relation is found for the dehydration process, $Q/\log k_0$ being here about 2 times larger.

The dehydration proceeds on the surface of nickel and the dehydration on that of alumina. Geometrically these surfaces are situated separately. But the energies of activation characterizing the processes are related one to another. Hence, the places where both reactions occur must geometrically be connected, and this can happen only at the nickel–alumina interfaces. Thus, one can conclude that the reaction on a mixed catalyst is located on its component interfaces.

In the systems considered there are two solid phases and one gaseous phase. Three phases can join together only by lines (or points) but not by surfaces. As the logarithmic relation shows, these active lines possess a varying activity. This property is the same as that of surfaces and crystal edges in the theory of H. S. Taylor [*J. Phys. Chem.*, **30**, 145 (1926); *Acta Ph. Ch. U. R. S. S.*, **1**, 397 (1935)]; however, these lines are not edges, since the micro-crystals but seldom join together by edges. These boundary lines resemble those of the Schwab and Pietsch topochemical theory [*Z. physik. Chem.*, **B1**, 385 (1928)], but are endowed with a varying activity in the sense of the theory of Taylor (*loc. cit.*) and Constable [*Proc. Roy. Soc.* (London), **A108**, 355 (1925)]. This new fact has to be taken into account in the theory of catalytic action.

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