

$$p_0 = 2.4 \sigma \left(\frac{\sigma \rho}{h^4} \right)^{1/7} \quad (5)$$

$$a = 2.4 V^2 \sigma \left(\frac{\sigma \rho}{h^4} \right)^{1/7}, \quad (6)$$

where V is the molecular volume of the liquid. A comparison between the theoretical and experimental values shows that the variation of 'a' with σ and ρ is as required by the theory but the constant of proportionality is nearly 0.6 times its theoretical value.

University of Delhi,
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F. C. AULUCK.
R. N. RAI.

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CATALYTIC FORMATION OF METHANE FROM CARBON MONOXIDE AND HYDROGEN—A STUDY OF NICKEL AND NICKEL ALUMINA CATALYSTS PREPARED FROM THE HYDROXIDE USING POTASSIUM, SODIUM AND AMMONIUM HYDROXIDES AS PRECIPITANTS

In a humid mixture of carbon monoxide and hydrogen 1:1 (roughly) by volume the following reactions took place in presence of nickel catalysts.

1. $2CO + 2H_2 = CH_4 + CO_2$.
2. $CO + H_2O = CO_2 + H_2$.

The influence of potassium, sodium and ammonium hydroxides used as precipitants for preparing the nickel catalysts on the relative rate of the above reactions if any was small and will be evident from the experiment No. 1_K, 1_{Na}, and 1_{Am}, in Table I.

The effect of alumina as a promoter for favouring the reaction 1 was prominent and this is borne out by the comparative study of Table I with Table II where II_K, II_{Na}, and II_{Am} are alumina promoted catalysts. Moreover the promoter action of alumina depends on its concentration also. This will be clear if we compare Table II where the catalysts contain alumina to the extent of 0.085 per cent. with Table III wherein the catalysts III_K, III_{Na}, and III_{Am}, the alumina content is 0.160 per cent. We find that concentration of the promoter for highest activity should be a figure which is lower than 0.160 per cent.

On the other hand Table IV will show that on addition of traces of potassium carbonate to the alumina promoted catalysts (II_K and II_{Am}) reaction 2 is preferentially accelerated.

Department of Chemistry,

Dacca University,
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K. M. CHAKRAVARTY.
J. M. SARKER.

Expt. No.*	Wt. of catalyst in gm. in tube	Vol. of catalyst in tube in c.c.	% composition of reactants			Space vel. N.T.P. per hr.	No. of litres of gas passing	Reaction temp.	% composition of the resultants				CO ₂ -CH ₄	CH ₄ † CO ₂ -CH ₄	
			% CO	% H ₂	% H ₂ O				% CO ₂	% CH ₄	% H ₂	% CO			% H ₂ O
TABLE I															
K	5028	3.77	30.31	38.77	31.27	206	25	387.2	21.32	15.01	26.72	2.68	34.27	6.31	2.39
Na	5018	"	29.70	39.51	30.87	205	"	"	20.85	15.17	26.82	2.58	34.58	5.68	2.67
Am	4998	"	30.47	38.51	31.02	205	"	"	21.66	15.46	25.70	2.78	34.41	6.20	2.48
TABLE II															
II _K	5009	3.77	30.32	37.90	31.78	207	25	340	21.08	18.27	18.70	1.37	39.88	3.53	5.17
II _{Na}	5000	"	31.00	36.60	32.40	208	"	341	22.74	19.20	15.69	0.98	41.39	3.52	5.51
II _{Am}	4980	"	29.96	38.28	31.76	208	"	340.1	21.42	18.20	19.00	1.20	40.06	3.22	5.65
TABLE III															
III _K	5008	3.77	30.10	37.65	32.25	207	25	339.1	21.74	17.52	20.01	1.40	39.33	4.22	4.15
III _{Na}	5000	"	30.68	37.17	33.29	207	"	339.3	21.84	17.43	19.63	1.33	39.22	4.36	4.00
III _{Am}	5004	"	30.65	39.02	30.33	207	"	339.5	22.37	17.99	21.39	1.34	39.91	4.38	4.05
TABLE IV															
II _K +K ₂ CO ₃	5007	3.77	30.49	38.33	30.68	207	25	340.2	22.67	18.76	19.77	0.49	38.28	3.91	4.75
II _{Am} +K ₂ CO ₃	5000	"	20.45	38.43	31.02	207	"	340.5	22.59	18.69	19.45	0.56	38.71	3.90	4.71

* Suffix K, Na and Am after I, II, and III indicates that catalysts have been prepared under identical conditions using respectively KOH, NaOH and NH₄OH as precipitants.

† CH₄/CO₂-CH₄ indicates the ratio of the rate of reaction (1) to that of reaction (2).