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An Experimental Study of the Ionicity of HgClBr

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INTRODUCTION

It has been experimentally established that in a solid-solid capillary reaction between two reactants, at least one of which is fairly ionic having a small inorganic impurity mixed with these, the amount of the product formed, at a given time, is more for an impurity the molecule of which has a higher electric dipole moment compared to the case of an impurity the electric dipole moment of which is less. This amount of the impurity is taken such that, in each case, there are nearly same number of impurity molecules.

This is seen to be the case from Fig. 1 which presents a plot of $(\log_{10}x)$ x10^2 vs. $(\log_{10}t)$ x

**Table 1: Thickness of product layer with pure reactants
and different Impurities (In increasing dipole moment order)**

| Time	Thickness of product layer$(\log_{10} x_i)$x10^2							
$(\log_{10}t_i)$ x10^2	Pure Reactants	HgClBr Ist method	HgClBr IIndmethod	HgClBr IIIrdmethod	HgBrI	NaCl	NaI	KCl
- 60.2	-215	-205	-210	-210	-210	-185	-182	-180
- 30.1	-205	-200	-200	-200	-200	-180	-177	-174
-12.5	-196	-200	-200	-200	-196	-174	-172	-170
0.0	-189	-200	-196	-200	-192	-172	-170	-166
9.70	-180	-200	-196	-196	-192	-170	-168	-162
17.6	-174	-200	-196	-196	-189	-168	-166	-159
24.3	-170	-200	-196	-196	-189	-166	164	-157
30.1	-170	-200	-196	-196	-189	-164	-162	-155
35.2	-170	-200	-196	-196	-189	-164	-160	-155
39.8	-170	-200	-196	-196	-189	-164	-160	-155
43.9	-170	-200	-196	-196	-189	-160	160	-155
47.7	-170	-200	-196	-196	-189	-160	-160	-155
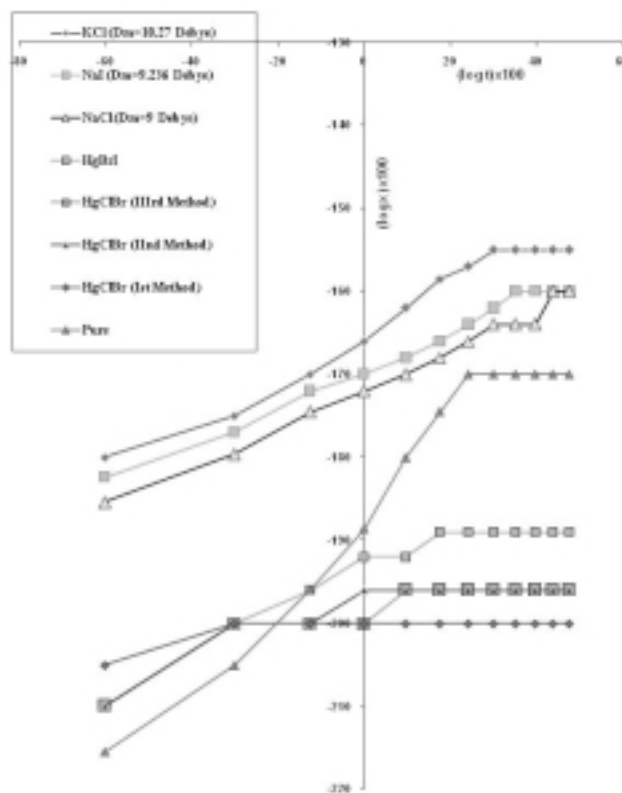
**Fig. 1: Kinetics of solid - solid reactions between CuI + HgCl$_2$
with different inorganic solid impurities at 80°C**

10^2, where x is the thickness of the product at time t after the start of the experiment for the system CuI-HgCl$_2$.

The numerical data are given in Table 1. We see that the amount of the product, for a given time, depends monotonically on the electric moment of the impurity molecule. The electric dipole moment have been taken from ref. 1. This is in accordance with a plausible theory. The curve for HgClBr, as prepared by three different methods and a curve for HgBrI are also shown in the figure. All these curves occur at the bottom of the figure well below the curve for the pure reactants. This goes to show that HgClBr as well as HgBrI have low ionicity. This is in accord with Pauling's simple semi-empirical theory of ionicity[2]. Details may be presented elsewhere.

This was presented in Poster form at the International Conference held at IIT, Roorkee.

REFERENCES

1.   Lide D.R., CRC handbook of Chemistry and Physics, CRC Press, (2002).

2.   Pauling L., The nature of the chemical bond, 3rd edition, Oxford & IBH Publishing Co, p.98.