Chapter IV

EXPERIMENTAL RESULTS

Experiments were performed according to the operating conditions summerized in Table 3.1. Data and calculated results are tabulated in Appendix C. The results were calculated as shown in Appendix D.

As is shown in Table 3.1, experiments were divided into six groups with the aim of varying the NaOH concentration from 0% up to 0.099%. For each concentration, six runs were made at different Reynolds numbersto see the effect of hydrodynamics on the rate of mass transfer in dense phase region using a perforated distributor.

4.1 Correlation between ϵ and Re

Fig.4.1 shows the plots of Re versus ϵ on log-log scale. Straight lines were obtained for different particle diameters. All straight lines were parallel with an average slope of 2.39. Table 4.1 shows values of individual slope for various particle diameters.

4.2 Influence of Hydrodynamic Condition on Mass Transfer

The mass transfer results were reported in terms of $Sh\,\epsilon^{1.25}Sc^{-1/3}$. The variation of $Sh\,\epsilon^{1.25}Sc^{-1/3}$ against Re at different NaOH concentration can be conveniently represented by straight parallel lines on log-log scale plot as shown in Fig.4.2.

Values of slope or exponent of Re and value of K_1 are shown in Table 4.2. The average values were 0.584 and 0.686, respectively.

4.3 Evaluation of Mass Transfer due to Chemical Reaction

In order to see the effect of chemical reaction on the rate of mass transfer, the Eq.(2.20) was used to interpret the results. First, a plot was made on log-log scale between $K_2 Cr^n$ and Cr at constant Re of 150. This was done as follows. A straight vertical line at Re=150 was drawn in Fig.4.2. The difference between the ordinate axis values of the experiment without chemical reaction and the experiment with chemical reaction were calculated and taken to be equal to $K_2 Cr^n$. Table C.7 gives values for such calculations. The plot in Fig.4.3 shows a straight line on log-log scale with a slope of 1.369. This is the value of n in Eq.(2.20). The value of K_2 was found from the same plot to be 187.1.

The new correlation of mass transfer with chemical reaction in fluidized bed is then proposed to be

$$Sh \epsilon^{1.25} Sc^{-1/3} = 0.686\ Re^{0.584} + 187.1\ Cr^{1.369} \qquad (4.1)$$

Table 4.1 Correlation between ϵ and Re

$dp \times 10^2$	Slope
0.5850	2.39
0.5594	2.42
0.5196	2.40
0.4560	2.36
0.4012	2.40
0.3596	2.37

Average slope of ϵ with Re at different particle diameters = 2.39

Table 4.2 Value of Exponent of Re and Value of Constant K_1

C_{A1}, %	Slope	K_1
0	0.583	0.686
0.011	0.583	0.687
0.026	0.586	0.685
0.049	0.584	0.687
0.075	0.585	0.686
0.099	0.585	0.686

Average slope or exponent of Re = 0.584

Average constant value of K_1 = 0.686

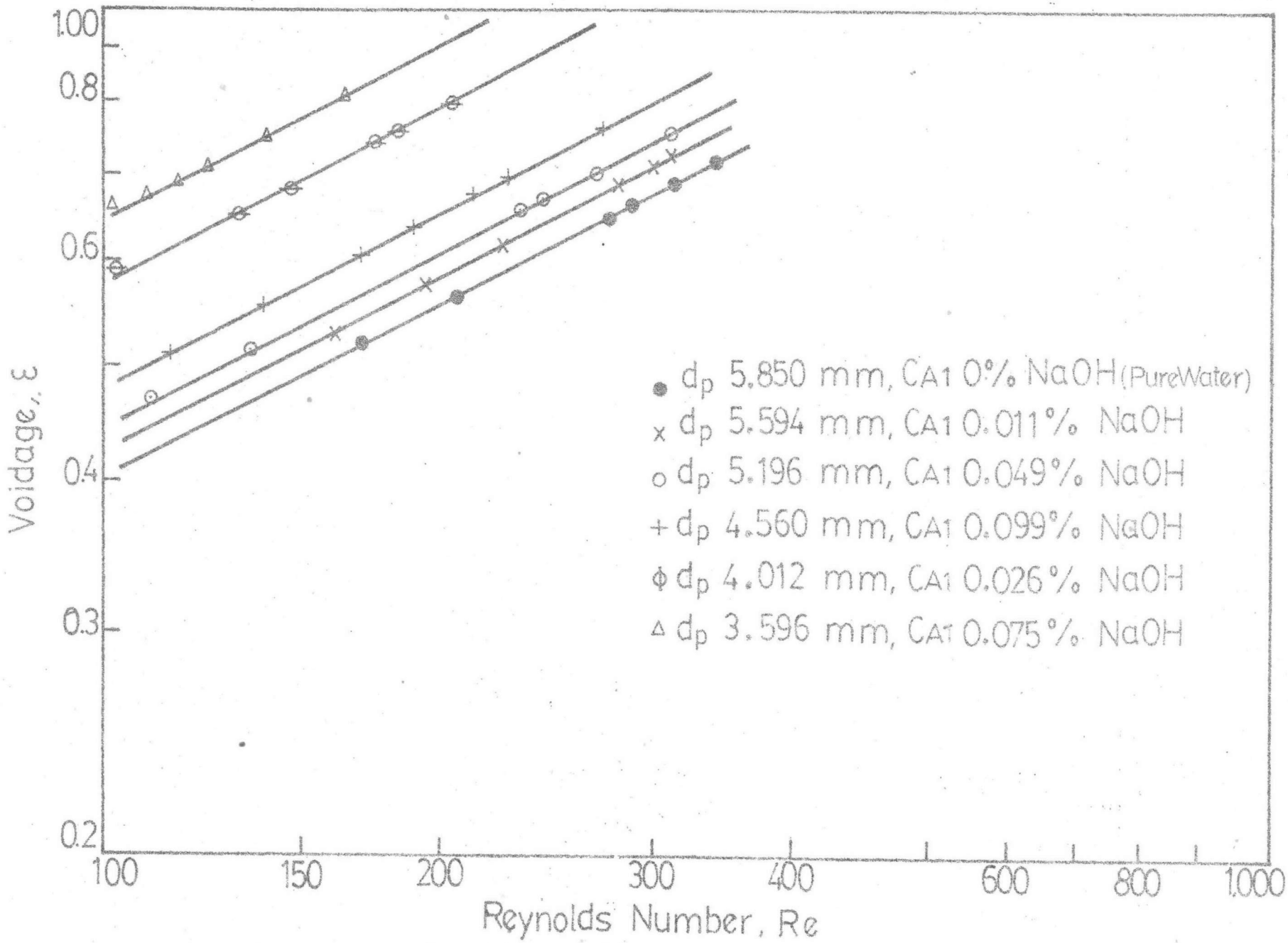

Fig.4.1 Variation of ∈ with Re at Different NaOH Concentrations

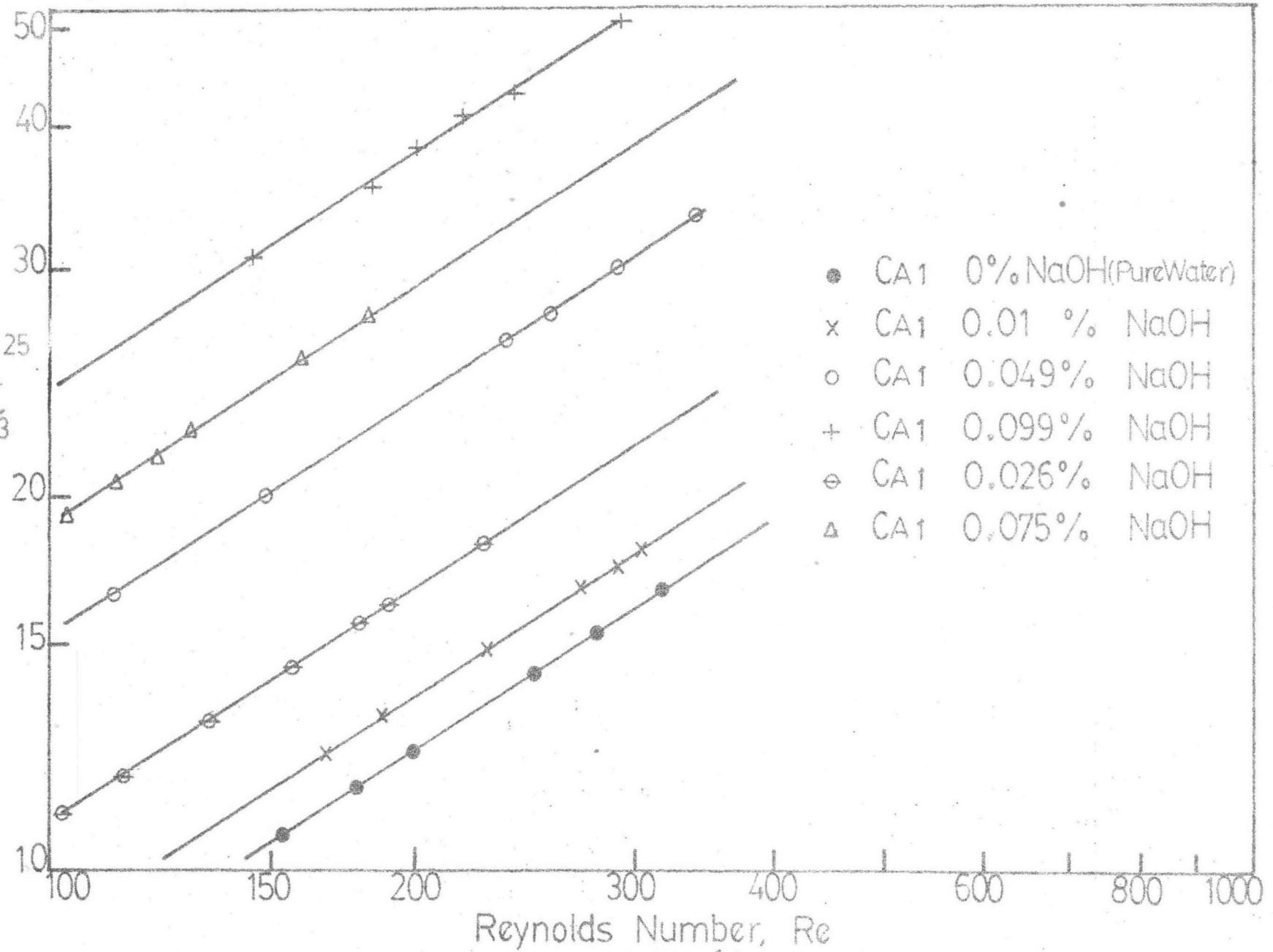

Fig.4.2 Variation of $Sh\,\epsilon^{1.25}Sc^{-1/3}$ with Re at Different NaOH Concentrations

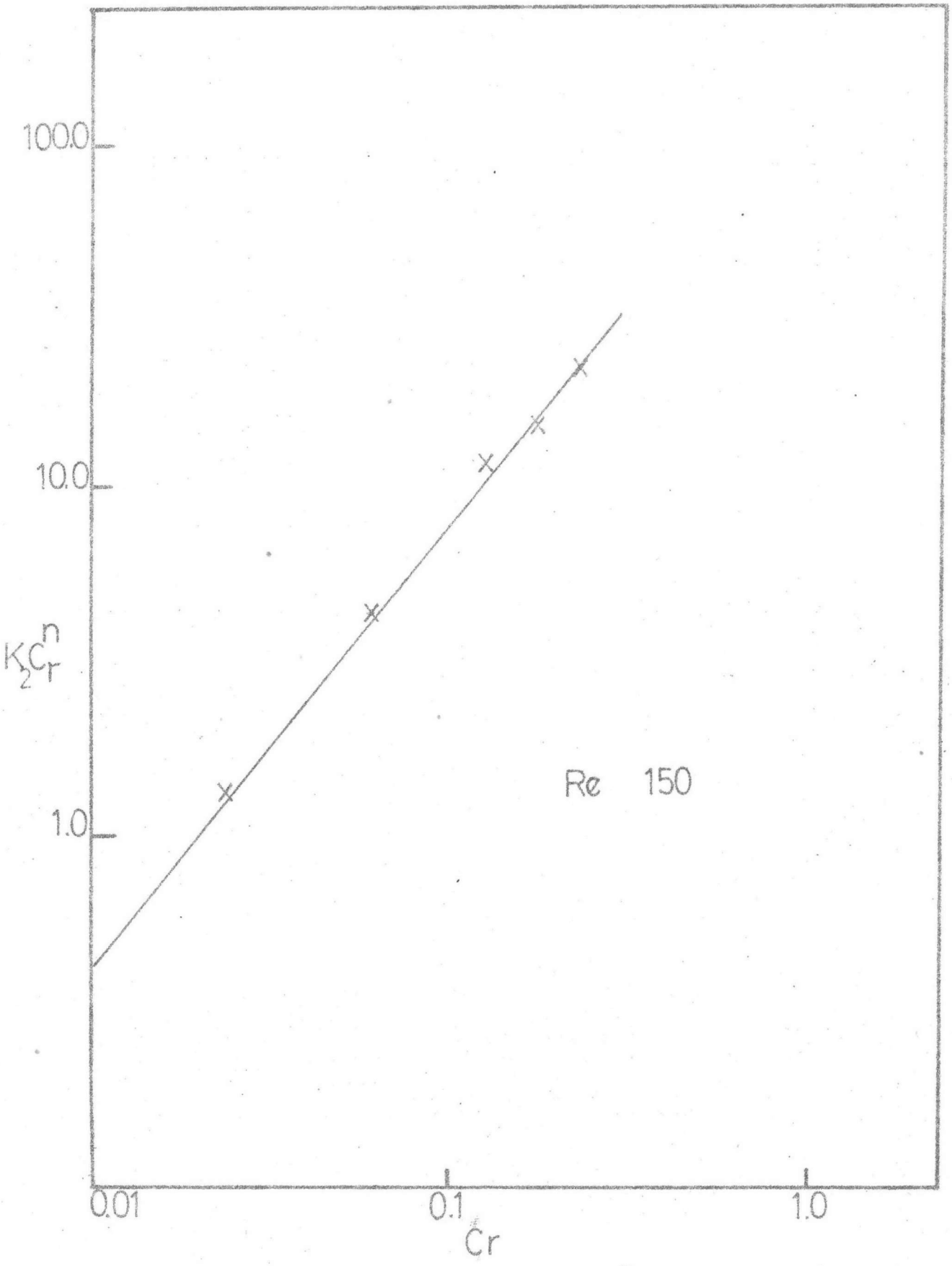

Fig.4.3 Variation of K_2Cr^n with Cr