

The Pre-precipitate Zones Occurring after the Experiments of Moving Chemical Reaction Boundary Formed by Co^{2+} and OH^{-} *

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1 Introduction

Recently^[1-3], the concept of moving chemical reaction boundary(MCRB), coupled with stationary chemical reaction boundary(SCRB), was developed from the ideas of "precipitate reaction front" by Deman-Rigole^[4,5] and of stationary neutralization reaction boundary by Pospichal *et al.*^[6,7], and some moving chemical reaction boundary equations(MCRBE) were deduced. More recently^[8], the relations between the MCRB and Svensson's isoelectric focusing(IEF) were discussed. The theory of MCRB has been proved by some analyses of experimental data^[2,9] and the experiments of MCRB formed with cobalt ion and hydroxyl ion^[10].

In the experiments of MCRB formed with CoCl_2 and NaOH in 1%(w/V) agarose gel containing $0.1 \text{ mol}\cdot\text{L}^{-1}$ background electrolyte KCl ^[3], we also observed the "pre-precipitate zones /or disks" — an accompanying phenomenon — the mechanism of which is still unclear, appears gradually after the experiments of MCRB.

Therefore, we report the "pre-precipitate zone/or disk" and discuss its possible mechanism.

2 Experiments and Procedures

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The experiments of MCRB formed with CoCl_2 and NaOH , coupled with $0.1 \text{ mol}\cdot\text{L}^{-1}$ background electrolyte KCl follow mainly to the procedure invented by Deman and Rigole^[4,5], but with some modifications as shown in ref.10. The gel used here is 1%(w/V) agarose gel(having low electroosmotic flow, EOF), but not the agar gel(having high EOF); the experiments are performed in a disk electrophoretic trough(Beijing Luyi Instrument Factory, Beijing) joined with a power supply(DYY-III, Beijing Luyi Instrument Factory).

3 Results and Discussions

Just after each run of MCRB experiment, the precipitate zone, which is the length from the cathodic end of “-” to the boundary indicated by an arrow(see Fig. 1,2), is determined with a rule. This is used for the calculation of the observed velocity of MCRB, as has been shown in ref.10.

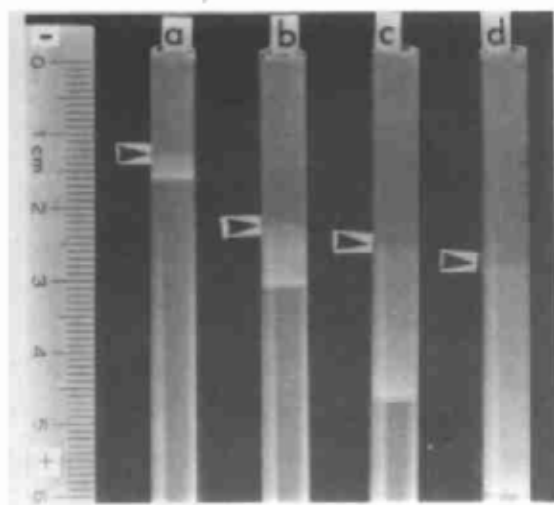


Fig.1 The precipitate zones formed during the runs and the “pre-precipitate zones” observed about 12 hours after the runs

The symbols, “+” and “-”, mean the anode and cathode respectively, the arrows indicate the boundaries formed just after the end of run. The precipitate zones are from the cathodic ends of “-” to the arrows, and the “pre-precipitate zones” developed after a run are just under the arrows. The concentration, $c_{\text{Co}^{2+}}^0$ is fixed at $0.01 \text{ mol}\cdot\text{L}^{-1}$; **a**: $c_{\text{OH}^-}^0 = 0.005 \text{ mol}\cdot\text{L}^{-1}$, **b**: $c_{\text{OH}^-}^0 = 0.01 \text{ mol}\cdot\text{L}^{-1}$, **c**: $c_{\text{OH}^-}^0 = 0.015 \text{ mol}\cdot\text{L}^{-1}$ and **d**: $c_{\text{OH}^-}^0 = 0.02 \text{ mol}\cdot\text{L}^{-1}$. Conditions: background electrolyte $0.1 \text{ mol}\cdot\text{L}^{-1}$ KCl ; constant voltage 50 V; LD of tube is 4.6 mm and length of tube is 90 mm; run time 10 minutes; each run with two tubes

However, the blue “pre-precipitate zone”, which is always ahead of the boundary

of MCRB formed by CoCl_2 and NaOH , is developed after a run. The "pre precipitate zone" can be observed (but is short and weak) about 30 minutes after a run, and becomes longer about 5 hours later, and becomes a series of bands/or disks about 12 hours later (see Fig.1). The numbers and shapes of bands/or disks are constant even a week after a run. It is observed from Fig.1 and 2 that the blue "pre-precipitate zone" is not uniform, since the more ahead of the more dense the zone/or banks exist(s), whereas the precipitate zone that is formed during the run is uniform over its whole zone. Fig.2 shows that both the precipitate zones and the "pre-precipitate zones" are quite constant if the same conditions are given. This indicates that good repeatability is achieved with the procedure in ref.4-7,10.

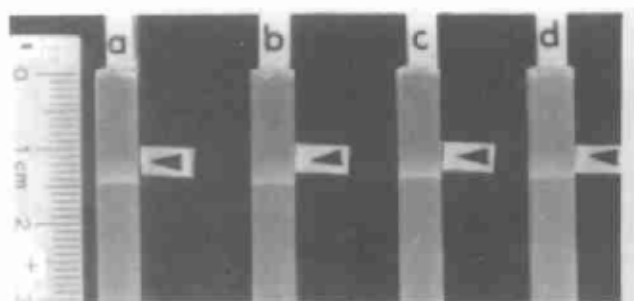


Fig.2 The quite constant precipitate zones and "pre-precipitate bands" observed about 12 hours after the runs

The conditions of "a", "b", "c", and "d" are constant: $c_{\text{Co}^{2+}}^0 = 0.014 \text{ mol}\cdot\text{L}^{-1}$, $c_{\text{OH}^-}^0 = 0.008 \text{ mol}\cdot\text{L}^{-1}$ and background electrolyte $0.1 \text{ mol}\cdot\text{L}^{-1} \text{ KCl}$; constant voltage 50 V ; I.D of tube is 4.4 mm and length of tube is 90 mm ; run time 10 minutes; each run with two tubes

The "pre-precipitate zone" observed by us is very different from that observed by Deman and Rigole^[4,5], since the former is formed after a run of MCRB experiment, but the latter is developed during a run, as has been observed by Deman and Rigole^[4,5].

The mechanism of "pre-precipitate zone" is, probably, that some precipitates are very fine and charged, they can penetrate the agarose gel and moves ahead the boundary, but after a run the fine precipitates aggregate to form the blue "pre-precipitate zone" gradually and a series of bands/or discs at last. However the exact mechanism is still unclear. It is calculated that some of the velocities of the "pre-precipitate zones" exceed that of hydroxyl ion — the fastest anion, and a gradient of "precipitate concentration" exists in the "pre-precipitate zone/or bands", but not in the precipitate zone (see Fig. 1-2).

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References

- 1 Cao C.-X. *Wuli Huaxue Xuebao*, 1997, 13: 827
- 2 Cao C.-X. *Wuli Huaxue Xuebao*, 1997, 13: 843
- 3 Cao C.-X. *Acta Chem. Scand.*, 1998, 52:709
- 4 Deman M, Rigole P. *J. Phys. Chem.*, 1970, 67:1122
- 5 Deman M. *Anal. Chem.*, 1970, 42: 321
- 6 Pospichal J, Deml M, Gebauer P, Bocek P. *J. Chromatogr.*, 1989, 470: 43
- 7 Pospichal J, Deml M, Bocek P. *J. Chromatogr.*, 1993, 638: 179
- 8 Cao C.-X. *J. Chromatogr.A*, 1998(in press)
- 9 Cao C.-X., *Journal of Anhui Normal University*, 1997, 20: 329
- 10 Cao C.-X., Chen W.-K. *Acta Chem. Scand.*, 1998, 52:714

移动化学反应界面实验后出现的前沉淀区带

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摘要 以 1% 的琼脂糖凝胶作抗对流介质 (内含的背景电解质 KCl), 进行了由氢离子和钴离子形成的移动化学反应界面的实验. 发现: 在实验完成后 30 分钟, 在原有的移动化学沉淀反应界面之前逐渐出现蓝色的前沉淀区带; 之后, 前沉淀区带逐渐延长, 大约 12 小时后其长度不再延长.