论文

对流扩散传质滞后的电极过程中之非Poisson涨落与非Nernst浓度极化

赵南蓉, 张文华, 罗久里

四川大学化学学院, 化学物理研究所, 成都 610064

摘要：

根据对流扩散传质滞后的恒稳电极过程中边界层的物理图像，提出了该类电极过程的简化随机模型，建立了相应的浓度极化的随机热力学理论，　　揭示了非Nernst浓度极化来自于随电流密度增大电极化学反应体系涨落分布的非Poisson化与对中心极限律的偏离，进一步阐明了与滞后的扩散步骤共存的对流传质对非Nernst浓度极化的效应及其规律. 同时，给出了对流引起的非Nernst浓度极化的随机热力学算例.

关键词： 对流扩散滞后电极过程　随机模型化　非Poisson涨落　非Nernst浓度极化　随机热力学

Non-Poisson Fluctuation and Non-Nernst Concentration Polarization in Irreversible Electrode Processes with Hysteretic Diffusion-convection Transport

ZHAO Nan-Rong, ZHANG Wen-Hua, LUO Jiu-Li*

Institute of Chemical Physics, College of Chemistry, Sichuan University, Chengdu 610064, China

Abstract:

In accordance with the physical picture of boundary layer in the stationary electrode processes with hysteretic diffusion-convection transport we suggest a simple stochastic model to describe this kind of electrode reaction system including the effect of non-equilibrium fluctuations. As a result, a stochastic thermodynamics is established for the concentration polarization arising from hysteresis of the diffusion-convection. Based on it, we further show that the non-Nernst concentration polarization originates in the non-equilibrium fluctuation which departs from the Poisson distributions and even from the central limit theorem, but decreases by the convection companying with diffusion. An example is also given to illustrate the stochastic calculation of the non-Nernst concentration polarization affected by convection.

Keywords: Electrode process with hysteretic diffusion-convection　Stochastic modeling　Non-Poisson fluctuation　Non-Nernst concentration polarization　Stochastic thermodynamics

通讯作者：罗久里，男，教授，博士生导师，主要从事非平衡态热力学研究，E-mail: jluoicp@yahoo.com

作者简介：

参考文献：

1. LUO Jiu-Li(罗久里), ZHAO Nan-Rong(赵南蓉). From Local Thermodynamics to Stochastic Thermodynamics(从局域平衡热力学到随机热力学)[M], Chengdu: Sichuan Science & Technology Press, 2004: 276—322
2. LUO Jiu-Li. J. Chem. Phys.[J], 1997, 106(9): 3587—3591
3. LUO Jiu-Li. J. Chem. Phys.[J], 1999, 110(10): 4937—4943
4. ZHAO Nan-Rong, LUO Jiu-Li. J. Chem. Phys.[J], 2002, 116: 5807—5815
5. ZHANG Wen-Hua(张文华), WEI Guo-Ying(卫国英), LUO Jiu-Li(罗久里). Chem. J. Chinese Universities(高等学校化学学报)[J], 2004, 25(9): 1693—1697
6. Frumkin A. N.. Kinetics of Eletrode Process[M], Moscow: Moscow University Press, 1952: 3—14
7. ZHA Quan-Xing(查全性). Introduction to Kinetics of Electrode Process(电极过程动力学导论)[M],

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Beijing: Science Press, 2002: 74—91

8. Malek-Mansour M., Van den Broeck C., Nicolis G., *et al.*. Ann. Phys.[J], 1981, 131: 283—313
9. Antropov L. I.. Theoretical Electrochemistry[M], Moscow: Mir Moscow, 1977: 403—433

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