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高浓度V(IV)/V(V)氧化还原反应的旋转圆盘电极动力学研究

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摘要 玻碳电极上, 采用循环伏安和旋转圆盘电极, 研究V(IV)/V(V)电对高浓度区的动力学特征。V(IV)/V(V)电对在玻碳电极上的反应为电化学准可逆过程, 与V(IV)氧化反应相比, V(V)的还原反应受动力学更慢。V(IV)离子的扩散系数和动力学参数与V(IV)和H₂SO₄浓度的关系研究表明, 用于液流储能电池活性离子V(IV)的浓度应在1M以上。且随V(IV)溶液和H₂SO₄浓度的增大, V(IV)离子的扩散系数逐渐降低, 而其动力学特征得以改善, 特别是, V(IV)和H₂SO₄浓度分别达到2mol·dm⁻³和4mol·dm⁻³时, 表现更为明显。

关键词 [全钒液流电池, V\(IV\)/V\(V\)电对, 高浓度, 旋转圆盘电极, 动力学参数](#)

分类号

Investigation on Concentrated V(IV)/V(V) Redox Reaction by Rotating Disc Voltammetry

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Abstract The kinetic characteristics of the concentrated V(IV)/V(V) couple have been studied at a glassy carbon electrode in sulfuric acid using rotating-disc electrode and cyclic voltammetry. The kinetics of the V(IV)/V(V) redox couple reaction was found to be electrochemically quasi-reversible with the slower kinetics for the V(V) reduction than that for the V(IV) oxidation. And, dependence of diffusion coefficients and kinetic parameters of V(IV) species on the V(IV) and H₂SO₄ concentration was investigated. It is shown that the concentration of active species V(IV) should be over 1 mol·L⁻¹ for the redox flow battery application. Further, with increasing the V(IV) and H₂SO₄ concentration, the diffusion coefficients of V(IV) were gradually reduced whereas its kinetics was improved considerably, especially in the case of V(IV) and H₂SO₄ up to 2 and 4 mol·L⁻¹.

Key words [vanadium redox flow battery](#) [V\(IV\)/V\(V\) couple](#) [high concentration](#) [rotating-disc electrode](#) [parameter](#)

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