Ion Transfer Voltammetry Associated with Two Polarizable Interfaces Within Water and Moderately Hydrophobic Ionic Liquid Systems

An electrochemical system composed of two polarizable interfaces (the metallic electrode|water and water|ionic liquid interfaces), namely two-polarized-interface (TPI) technique, has been proposed to explore the ion transfer processes between water and moderately hydrophobic ionic liquids (W|mIL), typically 1-octyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide (C8mimC1C1N) and 1-hexyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide (C6mimC1C1N). Within the classic four-electrode system, it is not likely that the ion transfer information at the W|mIL interface can be obtained due to an extremely narrow polarized potential window (ppw) caused by these moderately hydrophobic ionic components. In this article, we show that TPI technique has virtually eliminated the ppw limitation based on a controlling step of concentration polarization at the electrode|water interface. With the aid of this technique, the formal ion transfer potential differences between C1C1N− and Cnmim+ (n=6, 8) were accurately determined for 356 mV and 420 mV at a corresponding interface (W|C6mimC1C1N and W|C8mimC1C1N). Besides, this technique is used to monitor electrochemical polarization at the two W|mIL systems, which exhibits an adaptable polarizability (i.e., a conversion from a nonpolarized interface to a polarized interface). Some of the typical anion transfers at the W|C8mimC1C1N interface have also been investigated, as they are particularly important for ion extraction. The experimental results indicate that this facile TPI technique offers a general avenue to explore ion transfer in multifarious biphasic systems.

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