Temperature effect on Eu electrochemical intercalation into bilayer graphene interlayer

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Abstract

The electrochemical intercalation of metal ions into layered crystals became compatible with van der Waals technology resulting in customized properties different from parent materials and corresponding to broad energy storage applications. A strong interaction between rare earth metal (REM) and graphene makes the intercalation and diffusion of REM cations into graphene sheets interlayer different from that of alkali metal cations. Furthermore, the electrochemical intercalation of van der Waals crystals with REM cations is entirely unexplored. Here, we reported a significant temperature effect on the intercalation of REM europium (Eu) into a bilayer graphene interlayer using a combination of density functional theory calculations and electrochemical and transport experiments. To further discuss the effect of temperature on Eu intercalation and to separate the influence of temperature on the electrolyte ionic conductivity, we performed the electrochemical intercalation as a two-step process: (i) electrochemical reaction, and (ii) intercalation. We monitored in situ the charge carrier density of graphene, its time and temperature dependence, and revealed a strong temperature response of electrochemical intercalation of Eu ions in bilayer graphene.

References

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