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## Rational design of pre-intercalation electrodes for rechargeable battery

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Rational design of the morphology and complementary compounding of electrode materials have contributed substantially to improving battery performance, yet the capabilities of conventional electrode materials have remained limited in some key parameters including energy and power density, cycling stability etc., because of their intrinsic properties, especially the restricted thermodynamics of reactions and the inherent slow diffusion dynamics induced by the crystal structures. In contrast, pre-intercalation of ions or molecules into the crystal structure with/without further lattice reconstruction could provide fundamental optimizations to overcome these intrinsic limitations. In this report, we discuss the essential optimization mechanisms of pre-intercalation in improving electronic conductivity and ionic diffusion, inhibiting “lattice breathing” and screening the carriers charge. We also summarize the current challenges in pre-intercalation and offer insights on future opportunities for the rational design of pre-intercalation electrodes in next-generation rechargeable batteries.

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