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(54) **HIGH PERFORMANCE FLOW BATTERY**

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(57) **ABSTRACT**

High performance flow batteries, based on alkaline zinc/ferro-ferricyanide rechargeable ("ZnFe") and similar flow batteries, may include one or more of the following improvements. First, the battery design has a cell stack comprising a low resistance positive electrode in at least one positive half cell and a low resistance negative electrode in at least one negative half cell, where the positive electrode and negative electrode resistances are selected for uniform high current density across a region of the cell stack. Second, a flow of electrolyte, such as zinc species in the ZnFe battery, with a high level of mixing through at least one negative half cell in a Zn deposition region proximate a deposition surface where the electrolyte close to the deposition surface has sufficiently high zinc concentration for deposition rates on the deposition surface that sustain the uniform high current density. The mixing in the flow may be induced by structures such as: conductive and non-conductive meshes; screens; ribbons; foam structures; arrays of cones, cylinders, or pyramids; and other arrangements of wires or tubes used solely or in combination with a planar electrode surface. Third, the zinc electrolyte has a high concentration and in some embodiments has a concentration greater than the equilibrium saturation concentration—the zinc electrolyte is super-saturated with Zn ions.

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