lower voltage compared to $LiFePO_4$ whereas the power density is limited by the $LiFePO_4$ cathode. The full cell power density of 4.5 kW/kg and energy density of 263 Wh/kg based on capacity limiting anatase TiO_2/graphene anode weight lies within these two limitations with $LiFePO_4$ cathode limiting the rate, which is opposite to conventional Li-ion batteries using graphite anode.

The cycling performance of the full cell battery at 1 C_m rate shown in FIG. **15** (*c*) indicates almost no fade even after 700 cycles with columbic efficiency reaching 100% over the entire cycling test except for the initial few cycles where irreversible loss has been observed. Such a stable full cell cycling performance is unknown in the prior art. The results confirm the ideal reversibility of the lithium ion batteries based on a combination of $LiFePO_4$-anatase TiO_2/graphene and the absence of losses due to parasitic processes, such as the electrolyte decomposition.

With emphasis on long life and low cost, along with safety, for the stationary applications, batteries of $LiFePO_4$ cathode and anatase/graphene composite anode have been optimized individually to better performance by minimizing the internal resistance and irreversible heat generation. While with relative low energy density, the unique Li-ion cells made from the optimized electrodes demonstrated negligible degradation after 700 cycles at 1 C_m rate. The excellent cycling performance makes the Li-ion battery of the present invention a particularly excellent storage technology for stationary energy storage or in particular in community storage (<100 KWhs).

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. Only certain embodiments have been shown and described, and all changes, equivalents, and modifications that come within the spirit of the invention described herein are desired to be protected. Any experiments, experimental examples, or experimental results provided herein are intended to be illustrative of the present invention and should not be considered limiting or restrictive with regard to the invention scope. Further, any theory, mechanism of operation, proof, or finding stated herein is meant to further enhance understanding of the present invention and is not intended to limit the present invention in any way to such theory, mechanism of operation, proof, or finding.

Thus, the specifics of this description and the attached drawings should not be interpreted to limit the scope of this invention to the specifics thereof. Rather, the scope of this invention should be evaluated with reference to the claims appended hereto. In reading the claims it is intended that when words such as "a", "an", "at least one", and "at least a portion" are used there is no intention to limit the claims to only one item unless specifically stated to the contrary in the claims. Further, when the language "at least a portion" and/or "a portion" is used, the claims may include a portion and/or the entire items unless specifically stated to the contrary. Likewise, where the term "input" or "output" is used in connection with an electric device or fluid processing unit, it should be understood to comprehend singular or plural and one or more signal channels or fluid lines as appropriate in the context. Finally, all publications, patents, and patent applications cited in this specification are herein incorporated by reference to the extent not inconsistent with the present disclosure as if each were specifically and individually indicated to be incorporated by reference and set forth in its entirety herein.

The invention claimed is:

1. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte, wherein the nanocomposite material has a specific capacity at least twice that of a titania material without graphene material at a charge/discharge rate greater than 20 C.

2. The lithium ion battery of claim **1** wherein the olivine structure is LiMPO4 and M is selected from the group consisting of Fe, Mn, Co, Ni and combinations thereof.

3. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte wherein the graphene and titania is sufficiently dispersed such that the specific capacity decays less than 5 percent over 300 cycles.

4. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte wherein the graphene and titania is sufficiently dispersed such that the specific capacity decays less than 2 percent over 300 cycles.

5. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte wherein the graphene and titania is sufficiently dispersed such that the specific capacity decays less than 1 percent over 300 cycles.

6. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte wherein the graphene and titania is sufficiently dispersed such that the specific capacity decays less than 1 percent over 700 cycles.

7. A lithium ion battery having an anode comprising at least one graphene layer having a thickness of 0.5 to 50 nm in contact with titania to form a nanocomposite material, a cathode comprising a lithium olivine structure, and an electrolyte wherein the graphene and titania is sufficiently dispersed such that the specific capacity decays less than 15 percent over 300 cycles wherein the nanocomposite material has a specific capacity at least twice that of a titania material without graphene material at a charge/discharge rate greater than 20 C about 10 C.

8. The lithium ion battery of claim **7** wherein the olivine structure is LiMPO4 and M is selected from the group consisting of Fe, Mn, Co, Ni and combinations thereof.

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