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LiFePO4 - an Ambient Temperature High Capacity Anode Material for Rechargeable Lithium Batteries

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LiFePO4, as a promising battery electrode material has further seen tremendous growth, especially in the recent lithium battery related R&D activities. Despite the cheaper, safer and non-toxic nature of LiFePO4 cathode with an apparently appreciable theoretical specific capacity value (170 mAh/g), certain critical and hampering problems that are concerned with the stringent synthesis conditions, inherent low electronic conductivity and slower lithium diffusion kinetics etc., remain as challenging issues only till date. It is well known that literature is replete with numerous synthetic approaches, which have been made with a view to prepare the title compound in its pure and conductive form. However, the room temperature electrochemical properties of LiFePO4 cathodes, especially when $x>1$ and under significant loadings remain with unsatisfactory results only. On the other hand, it is quite surprising that no attempt has so far been paid towards the wide possibility of exploring the anode performance characteristics of LiFePO4, despite the extensive research being carried out on the cathode behavior of the same. Therefore such an effort to understand the possible extent of exploitation of LiFePO4 as a potential lithium battery anode gains paramount importance. Hence, the present investigation was aimed at the exploration and exploitation of LiFePO4 compound as an ambient temperature anode for rechargeable lithium batteries, which is an ever first attempt of this kind. Towards this intriguing interest, the compound LiFePO4 was synthesized via. solid-state method and subjected further to physical as well as electrochemical anode performance characterization studies. Surprisingly, an initial capacity of ~620 mAh/g has been exhibited by LiFePO4 anode, which is about 4~5 times higher than the capacity of the corresponding LiFePO4 cathodes. Also an excellent coulombic efficiency value of 99 % has been shown by the compound, especially upon extended cycling. The extraordinarily higher specific capacity values of LiFePO4 anodes may be exploited suitably for practical lithium battery applications.