Phosphorus-based negative electrode materials for sodium batteries

Can phosphorus be used in negative electrodes of sodium ion batteries?
The studies on the use of phosphorus in negative electrodes of sodium-ion batteries date back to 2013 but even then it was already clear that phosphorus is the best material for this purpose.

Are nanostructured phosphorus based electrode materials suitable for lithium/sodium ion batteries?
Recently, various nanostructured phosphorus based anodes, which efficiently restrained the pulverization and supplied faster reaction kinetics, have been developed to solve these issues. This review aims to summarize the major progress of nanostructured phosphorus based electrode materials for lithium/sodium ion batteries.

Is phosphorus a reversible electrode for lithium ion batteries?
By and large,the characteristics of electrodes for reversible intercalation of lithium are higher than the characteristics of their sodium analogues; however,as applied to lithium-ion batteries phosphorus does rank below silicon. For sodium-ion batteries,silicon is of no special interest as the material of negative electrodes.

Are phosphate framework materials a promising electrode material for sodium ion batteries?
Due to the high structural stability, facile reaction mechanism and rich structural diversity, phosphate framework materials have attracted increasing attention as promising electrode materials for sodium ion batteries.

What materials are used for positive electrodes of sodium ion batteries?
A vast number of materials for positive electrodes of sodium-ion batteries were proposed and investigated,including various layered oxides,phosphates,sulfates,fluorides,polyanion compounds,organic polymers,etc. [16 - 23]. Electrodes of these materials demonstrated the specific capacity values of up to 200 mA h/g.

What phosphides can be used in sodium ion batteries?
Even at the current of 2560 mA/g,the capacity was about 400 mA h/g. Other phosphides were also proposed as the active material for negative electrode in sodium-ion batteries,for example,phosphides of nickel,copper,iron,cobalt,germanium,selenium,and silicon. The first study devoted to nickel phosphides was published in 2014 [133].

Phosphorus (P) is one of the most promising anode materials for sodium-ion batteries (SIBs) because of its high theoretical capacity upon Na storage (2590 mA h g -1), low sodiation potential (~0.4 V vs. Na/Na +) and natural abundance.

For a nonaqueous sodium-ion battery (NIB), phosphorus materials have been studied as the highest-capacity negative electrodes. However, the large volume change of phosphorus upon cycling at low voltage causes the

formation of new active surfaces and potentially results in electrolyte decomposition at the active surface, which remains one of the ...

In the recent years, attention is focused on phosphorus as the active material for negative electrodes of sodium-ion rechargeable batteries because it demonstrates the maximum theoretical capacity with respect to sodium intercalation. The studies published since 2013 on sodium intercalation into red phorphorus, black phosphorus, and ...

This review aims to summarize the major progress of nanostructured phosphorus based electrode materials for lithium/sodium ion batteries. We first examine the most widely-used design strategy of compositing phosphorus with various carbon materials, ranging from 0D particles, 1D tubes or fibers, 2D sheets to 3D frameworks. And then, the progress ...

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The development of attractive negative electrode materials with high energy density, excellent structural stability and safety is crucial to advance the practical applications of sodium-ion batteries in the market.

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Hence, the combination of abundant and environmentally benign elements (such as sodium, iron and phosphorus) with the use of ...

Phosphorus-based anode materials for sodium-ion batteries have drawn wide attention due to the high theoretical capacity and suitable sodium storage voltage. The poor electrical conductivity and big volume change during cycling processes, however, make their commercialization challenging.

Our studies are clearly indicated that the amorphization and producing hybrid composites with graphene and carbon nanotube structure are a simple and cost-effective ...

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