MULTIFUNCTIONAL ENGINEERED PARTICLE FOR A SECONDARY BATTERY AND METHOD OF MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority to U.S. Provisional Patent Application No. 63/086,400, filed October 1, 2020, and U.S. Provisional Patent Application No._____(formerly U.S. Patent Application No. 16/596,681), filed on October 8, 2019, each of which is hereby incorporated by reference herein in its entirety.

INCORPORATION BY REFERENCE

[0002] All patents, patent applications and publications cited herein are hereby incorporated by reference in their entirety for all purposes in order to more fully describe the state of the art as known to those skilled therein and to enable those skilled therein to understand the present disclosure.

TECHNICAL FIELD

[0003] This technology relates generally to secondary batteries or energy storage devices, and more specifically to a multifunctional engineered particle for use in secondary batteries or energy storage devices.

BACKGROUND

[0004] Alkali ion batteries are commonly used in portable electronic devices, electronic vehicles, and other applications. In general, alkali ion batteries operate by moving alkali ions, such as sodium and lithium, from a negative electrode to a positive electrode during discharge and then back to the negative electrode during charging. As the applications for alkali ion and other batteries grow, there is a continuing need for improved batteries with characteristics such as improved storage capacity.

SUMMARY

[0005] According to an exemplary embodiment, an engineered particle for an energy storage device includes an active material particle comprising an outer surface; a conductive coating disposed on the outer surface of the active material particle, the conductive coating comprising a MxAlySizOw film; and at least one carbon particle disposed within the conductive coating, wherein M is an alkali selected from the group consisting of Na and Li,

and $1 \leq x \leq 4$, $0 \leq y \leq 1$, $1 \leq z \leq 2$, and $3 \leq w \leq 6$. As disclosed, the engineered particle may include an active material particle including an outer surface, a conductive coating disposed on the outer surface of the active material particle, the conductive coating including a $Li_xAl_ySi_zO_w$ film, and at least one carbon particle disposed within the conductive coating. For the $Li_xAl_ySi_zO_w$ film, $1 \leq x \leq 4$, $0 \leq y \leq 1$, $1 \leq z \leq 2$, and $3 \leq w \leq 6$.