STRAIN TOLERANT PARTICLE STRUCTURES FOR HIGH ENERGY ANODE MATERIALS AND SYNTHESIS METHODS THEREOF

INCORPORATION BY REFERENCE TO ANY PRIORITY APPLICATIONS

[0001] The present application claims the benefit under 35 U.S.C. § 119(c) of U.S. Provisional Patent Application No. 62/897,071, filed September 06, 2019, which is incorporated herein by reference in its entirety under 37 C.F.R. § 1.57. Any and all applications for which a foreign or domestic priority claim is identified in the Application Data Sheet as filed with the present application are hereby incorporated by reference under 37 CFR 1.57.

BACKGROUND

Field

[0002] The present disclosure is generally directed in some embodiments towards powders, structures, precursors, and methods of manufacturing said powders and structures to form strain tolerant materials.

Description of the Related Art

[0003] Alloy-type anode materials, which include Si, SiO, and Sn alloys, have been an area of intense research for over 20 years. An advantage to this class of materials is a large increase in lithium (Li) storage capacity, or simply capacity, over conventional anode materials based on carbon (primarily graphite), as much as 10x in the case of Si compared to typical commercial graphite anodes. However, their adoption as a full replacement for graphite has been impeded by very poor cycle life. Silicon (Si) undergoes a 300% volume increase upon full lithiation, and 300% decrease upon subsequent delithiation. This massive volume cycling results in mechanical damage to the Si particles, which results in material disconnection, fresh surfaces that react with the electrolyte and consume lithium while passivating, and thus capacity loss and impedance growth, in as few as a few cycles in the worst case. As a result, alloy anodes have been limited commercially to blends of very fine alloy particles with graphite, generally at < 10% of the total active material. Promising cycle life improvements have been seen by producing nano-structures of alloy anode (e.g. arrays of