Self-Catalyzed Silicon Nanowire-on-Stainless Steel Large Scale 3D-Anodes for High-Capacity Lithium Ion Batteries (Ramot)

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Researchers at Tel Aviv University are developing a novel, high performance, low cost anode for Li-ion batteries
based on silicon nanostructures.

THE NEED

The demand for high energy and long cycle life rechargeable lithium-ion batteries is increasing with the growth
of markets such as mobile electronic devices and electric vehicles. Improvements of energy capacity and cycle
life enable longer operation times in portable applications. For electric vehicles longer range, higher performance, and better safety are essential. Most commercially available lithium-ion batteries use graphite as
the anode, with a maximum theoretical capacity of 372 mAh/g. Silicon anodes have attracted much attention
since silicon theoretical capacity is 4200 mAh/g, an order of magnitude greater than that of graphite. Thus,
silicon based anodes have the potential to increase the energy content of lithium ion batteries by a factor of
60%.

THE PROCESS TECHNOLGY

Researchers at Tel Aviv University developed a low-cost CVD process for fabricating a 3D silicon nanostructured
high energy density anode for lithium ion battery. The flexible electrodes are suitable for integration in the
current roll to roll winding production process of both cylindrical and pouch lithium ion cells, enabling the
integration of the developed anode production technology in battery production process for various applications
such as portable electronics (laptops, tablets, mobile phones and wearable electronics) and electric vehicles.

ADVANTAGES OVER PRESENT COMMERCIAL LITHIUM ION BATTERIES

- □ ◆10 higher anode energy density – over 3000 mAh/g vs. 300 mAh/g
- □ ◆2 higher battery energy density – 300 - 400 Wh/kg vs. 150 - 250 Wh/kg
- □ High surface capacity 3 - 4 mAh/cm2 vs. 2 - 4 mAh/cm2
- □ High current efficiency > 99.9%
- □ High number of cycles 500 - 800 cycles
- □ Safer than commercial batteries
- □ Ultra-low irreversible capacity □10%

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