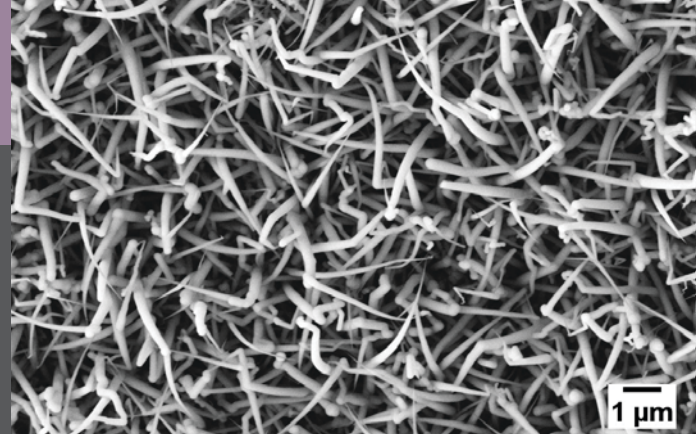
Growing Silicon Nanowires on Copper Substrate at Low Temperature



Problem Statement: The lithium-ion batteries have high energy density and are currently being used in Electric Vehicles (EVs) manufactured by Tesla, Maruti Suzuki, Ather Energy (Hero Moto Corp.), General Motors, Nissan, BMW and others. The researchers have designed silicon nanowires grown on copper foils that can be deployed as anode for lithium-ion batteries. The sodium-ion battery market is also on the rise, and these nanowires also find use as the anode in them. These silicon nanowires have tunable dimensions and morphology on copper substrates at low temperatures and can be used in applications like rechargeable lithium and sodium-ion batteries.

Uniqueness of the Solution: The bottom-up method of silicon nanowire growth allows fine-tuning the process parameters and thus the morphology and dimensions of silicon nanowires needed for a particular application. The growth through the unique hot wire assisted vapour liquid-solid mechanism allows the growth on a variety of substrates including, but not limited to, copper, stainless steel, glass, etc. The nanowires grown through this method have a composite structure consisting of crystalline core amorphous shell structure in a one-step process. Further, the growth of these nanowires directly on copper foils makes it a convenient electrode material for batteries that do not require any further processing before going into the device structure.

Current Status of Technology: The researchers have successfully demonstrated the battery prototype at the lab scale. They have also validated by integrating it in a standard consumer electronic device (Casio fx-991MS calculator, 0.2 mW). Another successful demonstration of this prototype was lighting up an array of 61 red LEDs arranged to spell out ‘IITB’ for about 60 minutes.

Societal Impact: The novel technology can be deployed as an anode in batteries used for EVs. Thus, this innovation can contribute to the betterment of society by providing clean energy for all and thus reducing the ill effects of climate change which are borne by the whole society.

Patent(s): under progress

Relevant Industries: Clean Energy, Renewables, Batteries, Supercapacitor.

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