

# BENEMÉRITA UNIVERSIDAD AUTÓNOMA DE PUEBLA



## INSTITUTO DE FÍSICA “Luis Rivera Terrazas”



### SEMINARIO “DR. JESUS REYES CORONA”

#### “High capacity anodes for Li-ion batteries and the use of synchrotron for understanding their exceptional performance”

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As a potential anode for Li ion batteries silicon has a theoretical capacity of 4200 mAh/g, more than ten times that of standard graphite anodes with a capacity of 370 mAh/g. Micro-structured Si in wire-shape overcomes problems caused by its four-fold volume expansion during its lithiation, allowing capacity stability over hundreds of cycles. A new concept of Si microwire anodes has been developed by the speaker. The anode consists of an array of Si microwires embedded at one end in a Cu current collector. The capacity of the anodes is very stable over 100 cycles, and breaks all the records when considering the capacity per area (mAh/cm<sup>2</sup>). Additionally, lately it has been observed that the wires withstand 500 cycles without indication of deterioration (information still unpublished). The mechanical stability of the wires is surprising, since their diameter ( $\approx 1 \mu\text{m}$ ) is far larger than what was deemed reasonable ( $< 300 \text{ nm}$ ) for avoiding cracking and assuring mechanical stability. The mechanical and electrical stability of the microwire anodes is exceptional. Nevertheless, not much is known about the reasons for the great performance. The solid electrolyte interface (SEI) on the wires may be a decisive factor for the mechanical stability, but microscopic data corroborating this thesis is still not available. Additionally, as the electron transport through the wires is good for many cycles (evidenced by the relatively fast charging rates, i. e. charging/discharging every 2 hours), it may happen that a Si channel remains intact upon cycling, but this has not been proved by any technique. As a consequence, it is unknown which wire length or thickness would be optimal. The micro-structural changes occurring during charging / discharging Si wires or particles in Li-ion batteries have been studied in the last few years, but the system is far from being understood. Preliminary results of the characterization of the anodes by synchrotron techniques will be presented in the talk.

**Auditorio-IFUAP**

**Viernes 11 de Agosto de 2017  
13:00 Hrs.**