



**ΟΜΙΛΗΤΕΣ:** **Katerina E. Aifantis**

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**ΘΕΜΑ:** **Nanostructured Li-ion batteries**

**ΤΟΠΟΣ:** Αίθουσα Σεμιναρίων ΙΤΕ/ΕΙΧΗΜΥΘ

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**ΩΡΑ:** **12:00**

**ΠΕΡΙΛΗΨΗ:**

Rechargeable Li-ion batteries are the main power sources in most portable electronic devices, and biomedical implants. Current Li-ion batteries employ graphite as their anodic material. The Li intercalation of graphite, however, is very low, and hence upon the formation of  $\text{LiC}_6$  a capacity of 372mAh/g is produced. Extensive experimental research has concluded that certain metal based composite materials are the most promising future anodes in rechargeable Li-ion batteries, since they allow for a maximum capacity, between 900 and 4000 mAh/g. The drawback, however, that keeps such anodes from commercial use is that upon the formation of Li alloys the active with respect to Li metals (such as Si and Sn) expand over 200%. As a result mechanical degradation takes place, which has as a direct consequence significant capacity loss during electrochemical cycling. To reduce this mechanical degradation the active materials are taken to have a nanometer length scale since at the nanoscale deformation mechanisms are less severe. Furthermore, to minimize the active site expansion, the nanosized active particles are embedded in a matrix that is less active with respect to Li forming, thus, a type of active/inactive composite. By employing a theoretical mechanical analysis to such systems the following design criteria can be obtained: i) smaller active site volume fractions are more stable; ii) Griffith's criterion can be used to estimate the crack radius at which cracking will stop; iii) based on the ultimate tensile strength of the inactive matrix the critical crack length at which the electrode will fracture can be calculated; iv) a theoretical estimation can be made for the size of the active sites that will not allow cracks to develop and hence fracture of the electrode can be prevented.