Enhancement of the performance in biomedical implantable devices using separators based on polymeric-ceramic composites

Abstract

Implantable electrical devices (IEDs) increase the probability to overcome heart events which otherwise would be mortal, help with chronic diseases such as hearing disabilities, neural disabilities and stimulate bone regeneration processes. To improve the performance of these electrical devices, the preparation of better separators to advance their power and energy densities properties is required. These separators are typically prepared based on polymeric materials, and affect the discharge rate of the IEDs. Soft materials such as polypropylene or polyamide with metatitanates based ceramic (e.g. barium titanate, calcium titanate, and strontium titanate), offer a feasible strategy to regulate the electrochemistry inside the device. These polymer/ceramic composites (PCCs) are prepared by phase inversion technique. In this process, the polymer is dissolve and intermixed with the ceramic of interest. Polyvinylidene fluoride (PVDF) and crystalline nanocellulose (CNC) are also added to the slurry to increase the interactions between the materials and to reinforce the mechanical properties of the separator, respectively. The final slurry is then, deposit using doctor blade technique over a glass plate, and placed inside a coagulating bath where the phase separation occurs, producing the separator. These separators will be characterized using surface and electrochemical techniques, and tested inside electrical double layer capacitor (EDLC) setups. Preliminary results using electrochemical impedance spectroscopy (EIS) analysis confirm ion transfer processes across the separators prepared.