3D RuO_2 microsupercapacitor electrodes based on Si nanowires, nanotrunks and nanotrees

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Energy autonomy keeps being a critical issue in the context of off-grid applications, such as autonomous wireless sensor networks, mostly being served by primary batteries. One solution to obtain a complete energetic autonomy of embedded microsystems, is to harvest and store the energy available in the environment, such as heat or vibrations. 3D on-chip microsupercapacitors show very interesting characteristics when it comes to these applications, thanks to their long lifetime and high power density [1].

In this work, pseudocapacitance of hydrous ruthenium oxide coated onto nanostructured silicon electrodes was investigated. Electrodeposition of hydrous ruthenium oxide was performed at room temperature by cyclic voltammetry from a 5 mM ruthenium chloride solution $RuCl_3$ on different nanostructured silicon electrodes (nanowires, nanotrunks and nanotrees) obtained by PECVD [2].

The resulted ruthenium oxide deposition was characterized by cyclic voltammetry in 0.5 M H_2SO_4 at different scan rates and by scanning electron microscopy (SEM). Capacitive behaviors were obtained for scan rates greater than 100 mV s^{-1} with a specific capacitance as high as 18.8 mF cm^{-2} for the coated silicon nanowires electrodes at 200 mV s^{-1}. This type of electrode material design is very promising for the integration of microsupercapacitors in wearable electronic devices and self-powered micro-systems, in which the key consideration is to minimize footprint occupancy while maximizing the energy.

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