Abstract Title : ALD Alumina Passivated Silicon Nanotrees electrodes for Ultrastable Microsupercapacitors Submitted to symposium Q : Synchrotron Radiation and Atomic Layer Deposition for Advanced Materials of the E-MRS 2017 Fall Meeting, which will be held at the Central Campus of Warsaw University of Technology (Poland) from September 18 to 21, 2017.

by Authors : P. Gentile, A. Valero, D. Gaboriau, M. Boniface, D. Aldakov, S. Sadki Affiliations : Univ. Grenoble Alpes, CEA, CNRS, INAC, SYMMES, F-38000 Grenoble

---

Abstract :

The current trend towards miniaturized and autonomous electronic devices requires innovative energy storage solutions. For instance, autonomous micro-sensor networks or implantable medical devices would need a robust power source with high cyclability and a large power density, which might be out of the scope of conventional battery technologies. For such applications, microsupercapacitors (µSCs) are promising alternatives, and their integration ?on-chip? could allow significant innovations. However, finding a suitable ?on-chip? µSCs technology implies addressing key challenges, such as temperature resistance, silicon industry compatibility and good electrochemical performances on a small footprint. Nanostructures such as SiNWs and SiNTrs demonstrated excellent cyclability with more than 1 million cycles of galvanostatic charge/discharge under a 4 V wide electrochemical windows in EMI-TFSI ionic liquid, with large power densities and good capacitance values. Moreover, the use of silicon for electrode material allows extremely interesting developments towards ?on-chip? integration and potential scale-up production using standard silicon industry processes for small micro-sized energy storage devices.

Furthermore, we have also investigated the impact of the addition of a high-k dielectric layer, such as Al2O3 as protective films on silicon nanotrees. The electrochemical performances was enhanced, allowing symmetric 2 electrodes device to reach an unprecedented cell voltage of 5.5 V, improving energy and maximum power densities compared to unmodified nanostructured silicon. The cyclability was also largely enhanced, with only 3% capacitance fade after 1 million galvanostatic charge/discharge cycles at 4 V, and no degradation even after several 100000 cycles over 5 V.

Abstract Type : Invited