Development and characterization of nano-composite capacitors based on tantalum-polymer

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The development of conducting polymers, especially in terms of environmental stability, imposes organic compounds as a new technology for electronic devices in specific areas of activity such as space, aerospace or defence. Following this trend, currently tantalum capacitors based on manganese dioxide cathode have been recently improved by the replacement of this cathode with a conducting polymer. Polymer Tantalum capacitors consist of a Ta anode sintered from Ta powder, an anodic oxide film of Ta as a dielectric, and a conductive polymer cathode typically made of poly 3,4-ethylenedioxythiophene (PEDOT). Until recently, capacitors based on PEDOT cathode have been optimized only for low capacities by in-situ polymerization. The next step is to reach higher capacities and improve the performance of capacitors using the conductive polymer. Our work is focus on the efficient insertion of the polymer into the device. The main study is the characterization of tantalum polymer capacitor via physico-chemical investigations carried out from the tantalum powder to conducting polymer and complete capacitor. We first studied the microstructure of tantalum network of existing capacitors by mercury porosimetry and observations by both scanning and transmission electronic microscopy. Afterwards, the solution containing PEDOT has been investigated by different techniques to determine parameters for the imbibition of tantalum anodes. This laboratory characterization is complemented by an assessment of the electrical performance of samples within the company. All this work has contributed to a new range of tantalum polymer capacitors available since the beginning of 2014 in the product catalogue of Firadec Company.