NEW SEPARATOR MATERIAL FOR SUPERCAPACITORS

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A new Separator for the use in double layer capacitors based on organic electrolyte solutions is presented. The Separator is made from Polypropylene which is processed in a first step by a special crystallisation process. In a second step the crystalline polypropylene matrix is transformed by a biaxial stretching process. As result a high porous separator made of a nanostructured polypropylene network is achieved.

Today's state of the art is the use of cellulose based separators (special paper) in double layer capacitors based on organic electrolytes. Advantage of paper based separators are the high porosity which results in low equivalence series resistance (ESR) of double layer capacitors, the compatibility to the electrolytes in use and of course the price advantage. Disadvantages of paper separators are poor mechanical properties such as low tensile- and puncture strength. Especially under exacerbate conditions (high temperature or high tension>2,5 V) the paper separator limits the service life of the double layer capacitors which is caused by capacity loss and increase of ESR.

In conventional capacitors polypropylene film is the most commonly material in use today. Reasons are for one the electrical performance of polypropylene films (high electrical strength, low dissipation factor) and second the excellent mechanical properties, resistance against solvents and chemistry, which leads to excellent service life. Finally the biaxial stretching process is a cost effective production process for such films.

Target of the presented development was to combine the advantageous properties of the paper, especially low ESR due to high porosity with the excellent properties of the polypropylene film like its high mechanical strength, electrochemical stability and high operating life.

Similar to the paper separator the new polypropylene separator shows a fibroid network-like structure where nano-scaled polypropylene fibers form a network of open cells. Its porosity of > 60% is in the range or even higher compared to paper separators. At the same time the polypropylene separator shows much better mechanical properties and chemical stability. By the biaxial stretching process it could be produced at to paper competitive prices.

Presented are REM-Pictures showing the nanostructure of the separator. In comparison to paper separators characteristic values of mechanical-, thermal- & chemical stability as well as electrical performance determined by impedance spectroscopy for the new separator material are shown. Furthermore results of a practice field test demonstrating the increased lifetime of double layer capacitors using the new polypropylene separator are shown.