eXPRESS Polymer Letters Vol.6, No.3 (2012) 177
Available online at www.expresspolymlett.com
DOI: 10.3144/expresspolymlett.2012.19

Editorial corner – a personal view
Future view of structural capacitor with laminated CFRP

*A. Todoroki**

Tokyo Institute of Technology, 2-12-1, Ookayama, Meguro, Tokyo, Japan

The great east Japan earthquake has destroyed much of the sea cost area of Japan, and the Fukushima nuclear power plants. The nuclear accident caused by the earthquake changed the Japanese energy policy. It reminded the Japanese people the necessity of making the maximum possible use of renewable energy.

This new trend may accelerate weight reduction in all kinds of vehicles and thus to reduce the electric energy consumption. By the end of summer of 2011, Toray Industries Inc. in Japan, announced a new concept car made from carbon fiber/polymer composites. EVs and hybrid cars are loaded with electric capacitors or batteries. These equipments cause weight increase and are space demanding.

Structural capacitors made of composite materials offer solutions for these issues. Structural capacitors were initially adopted as multifunctional composite materials for unmanned air vehicles (UAV) to save both weight and space. The structural battery is also used for the UAV, but their usage is limited to military applications due to life limitation. On the other hand, structural capacitors have long functional life.

All this accelerate research in the field of the structural capacitors. Since carbon-fiber/polymer composites conduct electricity, the carbon-fiber ply can be applied as electrodes. Electrical conductance of carbon-fiber reinforced polymer (CFRP) has been investigated for long time. Research mainly focused on monitoring the effect of applied strain or damages on the change of electrical resistance of CFRP structures. Here electric current is direct current or the frequency of the alternating current is low. Under these conditions the CFRP laminate behaves as a simple anisotropic conductive material. When the CFRP structure is used as a capacitor, the high frequency electrical properties become important. This means that the impedance behavior of laminated CFRP at high frequency will be a next target of research for structural capacitors.

The laminated CFRP usually has electric conductivity even in the thickness direction. This means that the normal laminated CFRP cannot be used for the structural capacitor. Even for the highly toughened laminated CFRP used for new aircrafts, the laminated CFRP has electric conductivity in the thickness direction although the highly toughened CFRP exhibits thick resin rich interlayer.

Laminated CFRP has not been considered as an electrical material but counted on structural material, so not too many studies were done at higher frequencies. I believe the careful researches at frequencies higher than 0.5 to 1 MHz) should be conducted in the near future. These investigations surely bring significant changes in energy policy in all over the world within the decades.

Prof. Dr. Akira Todoroki
Member of International Advisory Board

*Corresponding author, e-mail: atodorok@ginza.mes.titech.ac.jp