Structure and Barrier Properties of Conductive Polymer Coatings for Solid Electrolytic Capacitors

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The solid electrolyte capacitor has three major components including porous metal electrodes, metal oxide layers, and conductive polymer coatings. Plenty literatures indicate that these polymer coatings are able to incorporate with porous electrodes and enhance electrical contacts and outer encapsulation [1]. However, the desire of a thicker polymer coating through traditional polymerization always brings problems like an inhomogeneous surface and a poor coverage at the edge [2]. After assembling as device, these flaws will directly cause inexpectant malfunctions, leakage of current and poor yields.

In this study, we demonstrate that modified structure and barrier properties of conductive polymer coatings can have a great impact in high performances of solid capacitor. The coating procedure is initiated by mixing conductive polymers [poly 3,4-ethlyenedioxythiphene (PEDOT) and polystyrene sulfonate (PSS)] with sulfonated polyether ether ketone (sPEEK). Further heat treatments are necessary to optimize mechanical strength and framework integrity of coatings.

Based on this procedure, the amount of sPEEK seems to play an important role in constructing an ideal configuration of polymer coatings (Fig. 1**)**. The hydrophobic backbone structure of sPEEK is able to manipulate surface hydrophilicity of polymer coatings (Fig. 2), diminish the interface discrepancy, and also improve the coverage of coating onto porous electrodes.

After 1000h life test, the solid capacitors with modified polymer coatings clearly show a much better performance than pristine. The new procedure has a potential to fully replace expensive electrochemical polymerization [3-6] and simplify in-situ polymerization.

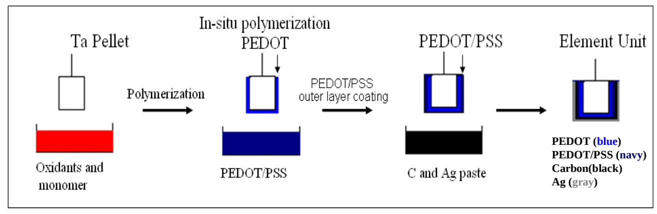

Figure 1. The outer layer coating process of the solid electrolytic capacitor

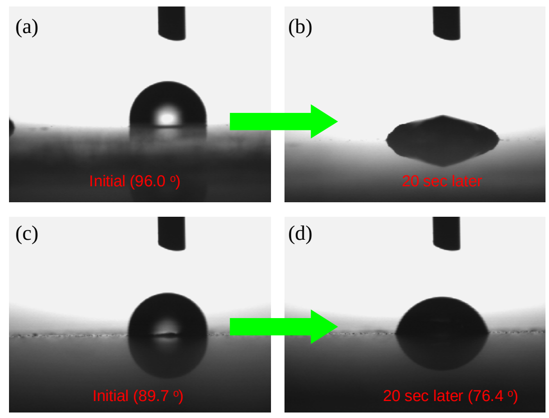

Figure 2. The dynamic contact angle images of the pristine polymer coatings (a)(b) and modified polymer coatings (c)(d). (After 20-second stabilization)

References

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