Study on Fe-doped Activation Carbon-based Supercapacitor at 4V

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Iron impurities will be mixed into the products during the production of supercapacitors due to wear and tear of equipment. So, this paper designs a Supercapacitor system of Fe-doped activated carbon, in a pouch scale, is studied with the use of organic electrolyte (salt of MeEt₃NBF₄ in the solvent of propylene carbonate) at 4V. Gas evolution, from the decomposition of electrode, electrolyte and the binders (sodium carboxymethyl cellulose and polymerized styrene butadiene rubber) is in situ analyzed with the simultaneous analysis of electrochemical signals, when the pouch of supercapacitor was integrated with a gas bag. The addition of Fe on activated carbon results in the production of H₂, CO and CO₂ as the dominant gases with the accelerated rate, while no CO and CO₂ are produced in the absence of Fe. The determination of the origin of gases suggests that salt of MeEt₃NBF₄ of electrolyte is firstly decomposed in the absence of Fe. While sodium carboxymethyl cellulose is firstly decomposed in the presence of Fe, due to its hydrophilic property and the structure of electrode sheet. A mode of gas evolution was established as considering processing technology and the hydrophilic properties of materials. The results provide a new insight on the “buckets effect” of supercapacitor that the metal impurities, exhibit much serious negative effect in decomposing components inside device, not limited to the decomposition of electrolyte as previously reported.

Keywords: Supercapacitor; Activated carbon; Organic electrolyte; Gas evolution; High voltage

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