Development of modified-cellulose in carbon dioxide switchable system as an alternative matrix for hybrid carbon cathode in lithium-air battery
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Abstract: Conductive modified-cellulose/carbon black (MC/CB) hybrid consisting of CO₂-switchable modified-cellulose and acetylene carbon black was developed for application as a cathode in the lithium-air battery. The role of MC is an alternative electrode matrix aims to enhance the dispersion of CB. Additionally, MC is expected to prevent electrode-cracking normally resulting after the fabrication. MC/CB hybrid was fabricated by the variation of MC that prepared at various temperatures (T) and pressures (P) of the CO₂-switchable system. Scanning electron microscopy (SEM) was employed to observe the surface structural-morphology of the composite and also cross-section for the investigation of porosity of the composite. A four-point probe technique was employed to measure the resistivity and conductivity (σ) of the lithium-air battery prepared from MC/CB hybrid. The results show that at various P and T, the MC appeared into two different forms; soluble (SMC) and precipitated (PMC). The MC/CB prepared from PMC shows de-structural (cracking) after drying and also shows lower porosity than that prepared from SMC. Nevertheless, the conductivity of the MC/CB prepared from SMC is lower. Furthermore, the investigation of lithium-air battery performance was conducted by the assembly of MC/CB at the cathode site of lithium-air coin cell type, following by the cell capacity measurement for 10 discharge-charged cycles.

Keywords: Carbon black; Cathode; Cellulose; CO₂ switchable solvent; Lithium-air battery