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CHEMICAL MODIFIED CARBON NANOTUBE-EPOXY LAMINATED WOVEN CARBON FIBER FABRIC COMPOSITES FOR USE AS A BIPOLAR PLATE

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Epoxy laminated woven carbon fiber mat composites for use as a bipolar plate component in polymer electrolyte membrane fuel cell (PEMFC) were prepared by hand-lay-up and compression molding processes to obtain highly formable sheets. Carbon nanotube was included in the epoxy matrix to improve properties of such composites in the through thickness direction. The purification of carbon nanotubes was carried out by acetone treatment. Subsequently, the surface modification of acetone treated carbon nanotubes was further accomplished by base treatment. The chemical treated carbon nanotubes were characterized by using SEM, TEM, TGA, and Raman spectroscopy. Properties of three groups of laminated composite materials, epoxy laminated woven carbon fiber fabric, carbon nanotube filled epoxy laminate woven carbon fiber mat, and base-modified acetone-treated carbon nanotube filled epoxy laminate woven carbon fiber mat were investigated. These laminated composites exhibited bulk electrical conductivity values of 5.5 x 10^2 - 2.0 x 10^3 S cm^{-1}, tensile strength of 0.50-0.65 GPa, flexural strength of 0.40-0.70 GPa, coefficient of thermal expansion of 39-77 x 10^{-6} $^oC^{-1}$, water contact angle of 84-90^o, and corrosion current of 0.4-1.0 µA cm^{-2} depending on the composition of laminated composites. This work opens up the possibility of using such base modified CNTs-epoxy laminate composite material as a bipolar plate in polymer electrolyte membrane fuel cell (PEMFC) application.