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# Catalytic graphitization of non-graphitizing carbons

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The slowdown of climate change requires vast utilization of “green”, bio-derived carbon materials. In fact, a growing number of biomass pyrolysis plants have come in recent years, and this may be a great source for the production of graphite for applications in energy storage and conversion. Current graphite production, whether obtained through high temperature (3000 °C) transformation (synthetic graphite) of graphitizing carbons or mining (natural graphite), is highly deleterious to the environment. Recently, many studies have demonstrated that biochars derived from pyrolyzed biomass and other non-graphitizing carbons could be converted to high purity, highly crystalline graphite [1,2]. Additional reports have shown the potential for the conversion of biomass to anode active materials of lithium-ion cells [3,4].

The most efficient method for the production of graphite from non-graphitizing carbons is catalytic graphitization. Typically, this process turns amorphous carbon into graphitic structures with the assistance of a transition metal catalyst such as Fe, Ni, Co, Mn, and Cr. Also, semi-metals, such as Si, cause a catalytic graphitization effect. What is more, the presence of catalyst particles can lower the temperature of the structural transformation towards graphite in both non-graphitizing and graphitizing carbon precursors.

This contribution will present recent progress in the catalytic graphitization of non-graphitizable carbons. The advantages and weak points of this technology and the resulting graphitic materials will be discussed. The poorly understood phenomena, such as the mechanism of the catalytic graphitization and the porosity collapse during the process, will be exposed. Finally, the potential of utilization of the catalytically-graphitized bio-carbons in the sodium-ion and lithium-ion technology will be evaluated. The literature achievement will be confronted with the experimental results (X-ray diffraction, small-angle scattering, Raman spectroscopy, scanning and transmission electron microscopy, electrochemical tests) obtained for catalytically-graphitized saccharides and furfuryl resins.

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