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Review of Carbon Materials: Application in Alternative Energy Sources and Catalysis

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Abstract : The application of carbon materials in the branches of the electrochemical industry shows an increasing tendency each year due to the many interesting properties they possess. These are, among others, a well-developed specific surface, porosity, high sorption capacity, good adsorption properties, low bulk density, electrical conductivity and chemical resistance. All these properties allow for their effective use, among others in supercapacitors, which can store electric charges of the order of 100 F due to carbon electrodes constituting the capacitor plates. Coals (including expanded graphite, carbon black, graphite carbon fibers, activated carbon) are commonly used in electrochemical methods of removing oil derivatives from water after tanker disasters, e.g. phenols and their derivatives by their electrochemical anodic oxidation. Phenol can occupy practically the entire surface of carbon material and leave the water clean of hydrophobic impurities. Regeneration of such electrodes is also not complicated, it is carried out by electrochemical methods consisting in unblocking the pores and reducing resistances, and thus their reactivation for subsequent adsorption processes. Graphite is commonly used as an anode material in lithium-ion cells, while due to the limited capacity it offers (372 mAh g-1), new solutions are sought that meet both capacitive, efficiency and economic criteria. Increasingly, biodegradable materials, green materials, biomass, waste (including agricultural waste) are used in order to reuse them and reduce greenhouse effects and, above all, to meet the biodegradability criterion necessary for the production of lithium-ion cells as chemical power sources. The most common of these materials are cellulose, starch, wheat, rice, and corn waste, e.g. from agricultural, paper and pharmaceutical production. Such products are subjected to appropriate treatments depending on the desired application (including chemical, thermal, electrochemical). Starch is a biodegradable polysaccharide that consists of polymeric units such as amylose and amylopectin that build an ordered (linear) and amorphous (branched) structure of the polymer. Carbon is also used as a catalyst. Elemental carbon has become available in many nano-structured forms representing the hybridization combinations found in the primary carbon allotropes, and the materials can be enriched with a large number of surface functional groups. There are many examples of catalytic applications of coal in the literature, but the development of this field has been hampered by the lack of a conceptual approach combining structure and function and a lack of understanding of material synthesis. In the context of catalytic applications, the integrity of carbon environmental management properties and parameters such as metal conductivity range and bond sequence management should be characterized. Such data, along with surface and textured information, can form the basis for the provision of network support services.

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