

Effect of temperature and voltage on the preparation of solid carbon by electrolysis of a molten CaCO₃-Li₂CO₃-LiCl electrolyte

ABSTRACT

The present study investigated the preparation of solid carbon through the electrolysis of a newly formulated molten salt electrolyte containing CaCO₃-Li₂CO₃-LiCl with a continuous cell voltage of 4 - 6V, and temperatures of 550 and 650°C. The process was carried out in a two-electrode cell using AISI 304 stainless steel electrodes in CO₂ gas environment. CO₂ gas was captured and electro-converted to solid carbon, and deposited on the cathode surface. SEM images revealed five dominant microstructures: grape-like, tubes, thread-like, spheres, and flakes. These materials consist of 69 - 80% carbon content based on EA analysis. Single wall nanotube structures of 13 - 90nm outer diameter was also detected under TEM analysis. The result revealed that electrolysis voltage and temperature changes affected the microstructures, quantity of the deposited carbon, and the efficiency of electro-conversion process. The size of the carbon microstructures declined, and carbon deposition rate increased as both voltage and temperature were increased. However, it reduced the efficiency of the process, thus using more energy per g of carbon produced.