

Synthesis of low ash coal based carbon foam

Abstract

Indian coals having very high ash content is difficult to clean. Those coals could be utilized in other high-end applications if ash content can be reduced significantly. Chemical beneficiation is the right approach as physical beneficiation has its own limitations for removing the coal ash content. Hence, solvent extraction process was used for removing the ash content from the coal. The Indian metallurgical coal having 17% ash content was taken for the solvent extraction. The coal was mixed with N-methyl-2-pyrrolidone (NMP) and ethylene diamine (EDA) in 1:10 ratio and heated to about 180 °C for 1 h. The solution was filtered twice (coarser and fine filtration) to get the two different clean coals. The solvent was recovered by evaporation. The clean coal thus obtained, was placed inside a tube furnace in alumina boat. The coal is heated to 600 °C with a heating rate of 3-5 °C/min under nitrogen flow of 2 LPM to get the green foam. It is kept at that temperature for 1-5 h and then cooled to room temperature. The green foam was carbonized at 1000 °C at the rate of 3 °C/min with holding time of 1 h to get the carbon foam. The foam is characterized with TGA, SEM, BET, density, proximate and ultimate analysis. The produced carbon foam had 6.9-8.3 MPa compressive strength and 0.21-0.22 g/cc density. The produced carbon foam can be used in various fields like structural materials, carbon-carbon composites and insulating material for furnace.

Keywords: Carbon foam, Clean coal, Solvent extraction, Structural materials