

Wettability and interfacial phenomena investigations on high-density polyethylene and petroleum coke

Abstract

An in-depth wettability and interfacial phenomena investigation was carried out to study interactions between high density polyethylene (HDPE) and petroleum coke. The aim is to investigate the effect of temperature and contact times on possible interactions and adhesion characteristics for partially substituting coal-tar pitch binder with waste polymers. Using a sessile drop arrangement, experimental assemblies consisting of ground HDPE and a petroleum coke substrate were heat treated in the temperature range of 150-350°C for 15-60 min. Contact angles between molten HDPE and petroleum coke surface and depth of penetration of HDPE into petroleum coke substrate were measured. The highest contact angle (131.5°) was observed at 250°C after 15 min. and lowest contact angle (30.9°) was observed at 350°C after 60 min. Highest penetration depth (75 μm) was observed at 350°C after 60 min and lowest penetration (13 μm) at 200°C after 15 min. Analysis of results showed that increasing time and temperature of heat treatment had a significant impact on the interactions of molten HDPE with petroleum coke. Longer residence time and higher temperatures increased the extent of melting of HDPE, which in turn resulted in improved wettability and deeper penetration into petroleum coke substrate. HDPE was found to bind and adhere strongly with petroleum coke.