

Formation of Carbon Black in DC and RF Thermal Plasma Torch Systems

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Recently, thermal plasmas are promising as new heat sources to produce the special grades of carbon black with a lower emission of CO₂ than conventional commercial process. In this presentation, carbon black is formed from methane with the aid of DC and RF induction torches to find the variation of its characteristics and the conversion rate of methane into carbon under the different thermal plasma environment. Firtstly, it is found that carbon black with the special morphology of wrinkled sheet and the high degree of graphitization is mostly obtained when the methane gas is injected into the periphery of DC arc jet. In this periphery, the temperatures drop sharply from arc jet to wall. By the axial introduction of methane gas into the RF plasma along the centerline, however, a large amount of the amorphous carbon black are produced with high conversion rate of methane, where the methane gas is expected to pass relatively uniform temperature fields and have enough time to be decomposed completely. These results indicate that the formation process of carbon black as well as conversion rate of methane into carbon is significantly dependent on the mixing structure and contacting time of methane with thermal plasma streams.