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The Effect of Microwave Irradiation on Carbon Black/High Density Polyethylene Conducting Composite

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In recent years, the positive temperature coefficient (PTC) polymer materials have been drawing more and more attention due to their advantages of relatively lower room- temperature resistivity, easy fabrication, and low cost over ceramic materials. The effect of microwave on PTC and crystalline structure of CB/HDPE composite was studied through WAXD, DSC and FTIR was studied in this paper. The experimental results show that owing to the thermal and non-thermal effect of microwave, the PTC intensity of CB/HDPE 40/60 composite is increased from 10.45 to15.42 in a few minutes irradiation (2.45GHz, 162.5W), the high PTC effect of CB/HDPE is achieved.

During irradiation, no remarkable change in grain size and the crystallinity of HDPE; the melting and crystallization behavior of HDPE matrix remain unchanged also. However the grain size does increase with the decrease of crystallinity in HDPE interface that changes from 29.13% to 12.11%. During irradiation, CB particles absorb microwave energy and heat HDPE all around, facilitate it to move to fill the ‘holes’ in the CB/HDPE interface. CB particles mainly exist in the amorphous phase of HDPE and the interface between the HDPE crystalline phase and its amorphous phase, the crystallinity in the CB/HDPE interface is decreased, thereby owing to the thermal effect of microwave. Owing to the non-thermal effect of microwave (plasma effect), some polar groups (mainly –NH group) appear in HDPE sample, the PTC effect is thus enhanced.