

Effect of Graphene Thickness on Water Vapor Transmission Rate and Thermal Properties of Graphene-HDPE Composites

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Thermoplastic liner are very effective solution in protecting metallic pipeline from internal corrosion. High density polyethylene (HDPE) thermoplastic is a one of the classic material used for liner. In recent years there are a number of study made to improve the barrier properties of the thermoplastic by incorporating impermeable 2-dimensional nanofillers, such as clay and graphene. The presence of these high aspect ratio nanofillers in the polymer matrix causes the diffusing molecules to follow longer pathways to pass through the nano-polymer film. In this present work the effect of graphene layer thickness on water barrier and thermal properties of HDPE film will be investigated. Graphene with thickness ranging from <1nm up to 10nm were mixed with HDPE through melt blending. The blended graphene-HDPE was then hot pressed into films with nominal thickness of 300 μm for water vapour transmission rate (WVTR) study. Study found that thinner graphene layer resulted greater reduction in water permeation as compared to thicker graphene.Visual inspection of this film proved that thinner graphene layer exhibited even particle distribution in HDPE. Thermal properties study also found that incorporation of 0.01 wt% of graphene resulted in 20% increment in degree of crystallinity and it is worth to highlight that graphene with lower thickness and higher aspect ratio demonstrated the highest degree of crystallinity. This suggested that the graphene could act as a good nucleating agent for HDPE polymer which it would increase crystallinity structure and subsequently lead in improving water barrier properties. On the other hand thermal stability of graphene HDPE film were not much affected by the graphene as the difference in decomposition temperature were marginal and no significant difference between the graphene thickness.

Biography

Shamsul obtained his B.Tech and M.Sc. in polymer from Science University of Malaysia with more than 15 years combined experience in product research, LDPE production plant and PE flexible packaging industry. Primarily interested in polymer analysis and characterisation for product failure analysis, improvement and product development. Extensive experience in polyolefin characterisation and conversion technology such as blown film machine and extrusion. Actively presented and published several journal papers related with polyolefin compounding and composites materials. Currently working with PETRONAS Research as a Staff Researcher to lead the development of polymer barrier materials for corrosion protection using nanomaterial technology.

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