

Chompunoot Chareonwutilap 2009: A Rheological Study of Dilute Carbon Black Suspensions for In-Mold Coating Applications. Master of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Mr. Chuckaphun Aramphongphun, Ph.D. 100 pages.

The objective of this research is to study about rheological behavior of dilute carbon black suspensions in macro and micro channels. The viscosity data in macroscale, which measured by a parallel-disc rheometer, were fitted by the Sisko viscosity model. The viscosity data in microscale were analyzed by the no-slip and slip boundary conditions to determine the slip length which occurs in the slip flow. The 2^3 Factorial designs were used to find factors that significantly affect the slip length. These factors include: (1) Content of carbon black: 0% and 2.5% by weight, (2) Surface chemistry: hydrophobic surface by silicone coating, with and without coating and (3) Surface roughness: $R_a = 0.85$ micrometer by grinding and $R_a = 0.94$ micrometer by Electrical Discharge Machining (EDM). The viscosity data in microscale were tested using a microslit rheometer, which were custom built and developed. This research work focuses on two temperatures: 25 and 50 °C.

According to the analysis of the slip length at both 25 and 50 °C, it was found that the content of carbon black, hydrophobic mold surface, and surface roughness of the mold significantly affect the slip length. The condition that gave the highest slip length for using in in-mold coating applications is 2.5% by weight carbon black, coated mold with silicone and used R_a 0.94 micrometer by EDM.

Student's signature

Thesis Advisor's signature

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