Increasing the Thermal Conductivity of Rubber by using Natural Graphite as an Additive

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Abstract

In liquid form, natural rubber is also known as latex (raw rubber) and the purified form of natural rubber is the polyisoprene, which can be used in many applications and products through the process of vulcanization. Rubber making process can be divided into four stages such as compounding, mixing, shaping and vulcanizing. In compounding stage, many additives such as vulcanizing agents, accelerators, activators, retarders, fillers and anti-degradants usually are added to improve properties of natural rubber. Two main reasons were expected by adding natural graphite as an additive such as improve thermal properties in rubber and less energy to cure the rubber products. Natural graphite is produced at Bogala Mines which has +99 carbon percentage and 40-micron particle size. Raw natural rubber has very low thermal conductivity such that rubber with a good thermal conductivity can withstand high temperatures without undergoing reversion or property changes. Therefore, this study focuses on the improving the thermal conductivity of rubber by using natural graphite as an additive. Three master batches were prepared on a laboratory two-roll mill by mixing 40-micron natural graphite (5PPHR (Parts per Hundred Rubber), 10PPHR and 15PPHR) with latex (raw rubber). Prepared three samples were sent to a laboratory in India to test the thermal conductivity by using Hot Disk TPS (Transient Plane Source). All the results were compared with corresponding control sample (0PPHR) which describes the behavior of thermal conductivity of three samples corresponding to the control sample. Test results showed that all three samples have higher thermal conductivity, compared to the control sample (2.60%, 1.33% and 1.93% respectively) and the thermal conductivity of 5PPHR sample was increased with time than other two samples. Further studies can be done to improve the thermal conductivity of rubber by functionalization of carbon with different groups like oxygen, carboxyl, amine, amide and fluorine which can drastically change the surface properties of graphite or graphene instead of raw natural graphite as an additive.

Keywords: Functionalized Graphite, Natural Graphite, Rubber, Thermal Conductivity