Journal Article – Volume 215, Industrial Crops and Products 2020, Pages 1 - 9

Utilization of waste high calcium oxide fly ash as hybrid activator for vulcanization of natural rubber/carbon black composites: Reducing zinc oxide requirement

Abstract

A high calcium oxide fly ash (FA), a by-product waste of electric power generation has been used as hybrid activator in natural rubber (NR) composites filled with carbon black (CB). The aim of using FA is to reduce the environmental contamination by zinc oxide (ZnO) needed as activator for sulfur-vulcanization/crosslinking in final NR products. The FA was varied by adding in the composites with and without ZnO, and it was observed that chemical crosslinking could be generated although no ZnO was used anymore. The synergistic FA/ZnO-blend with FA 9 phr and ZnO 3 phr presented the best fit for the NR/CB composites, where it showed a proper crosslink density, reinforcement efficiency, cure characteristics, and mechanical properties in terms of modulus, tensile strength, elongation at break and tear resistance. This relates to the inorganic composition of the FA, in particular calcium oxide (CaO), which induces the thermal conductivity throughout the NR matrix and activates crosslinking between the NR molecules. The results showed effective use of FA in the composites, which can be applied to the CB-based formulations used in commercial NR applications like tires, barriers, and elastic stopper.

Keywords

Activator; Fly ash; Mechanical properties; Natural rubber; Waste