

## Preparation and Properties of Chloroacetated Natural Rubber Rubber Foam Using Corn Starch as Curing Agent

**Authors :** Ploenpit Boochathum, Pitchayanad Kaolim, Phimjutha Srisangkaew

**Abstract :** In general, rubber foam is produced based on the sulfur curing system. However, the remaining sulfur in the rubber product waste is burned to sulfur dioxide gas causing the environment pollution. To avoid using sulfur as curing agent in the rubber foam products, this research work proposes non-sulfur curing system by using corn starch as a curing agent. The ether crosslinks were proposed to be produced via the functional bonding between hydroxyl groups of the starch molecules and chloroacetate groups added on the natural rubber molecules. The chloroacetated natural rubber (CNR) latex was prepared via the epoxidation reaction of the concentrated natural rubber latex, subsequently, epoxy rings were attacked by chloroacetic acid to produce hydroxyl groups and chloroacetate groups on the rubber molecules. Foaming agent namely NaHCO<sub>3</sub> was selected to add in the CNR latex due to the low decomposition temperature at about 50°C. The appropriate curing temperature was assigned to be 90°C that is above gelatinization temperature; 60-70°C, of starch. The effect of weight ratio of starch, i.e., 0 phr, 3 phr and 5 phr, on the physical properties of CNR rubber foam was investigated. It was found that density reduced from 0.81 g/cm<sup>3</sup> for 0 phr to 0.75 g/cm<sup>3</sup> for 3 phr and 0.79 g/cm<sup>3</sup> for 5 phr. The ability to return to its original thickness after prolonged compressive stresses of CNR rubber foam cured with starch loading of 5 phr was found to be considerably better than that of CNR rubber foam cured with starch 3 phr and CNR rubber foam without addition of starch according to the compression set that was determined to decrease from 66.67% to 40% and 26.67% with the increase loading of starch. The mechanical properties including tensile strength and modulus of CNR rubber foams cured using starch were determined to increase except that the elongation at break was found to decrease. In addition, all mechanical properties of CNR rubber foams cured with the starch 3 phr and 5 phr were found to be slightly different and drastically higher than those of CNR rubber foam without the addition of starch. This research work indicates that starch can be applicable as a curing agent for CNR rubber. This is confirmed by the increase of the elastic modulus (G') of CNR rubber foams that was cured with the starch over the CNR rubber foam without curing agent. This type of rubber foam is believed to be one of the biodegradable and environment-friendly product that can be cured at low temperature of 90°C.

**Keywords :** chloroacetated natural rubber, corn starch, non-sulfur curing system, rubber foam

**Conference Title :** ICMMPPE 2017 : International Conference on Materials, Minerals and Polymer Engineering

**Conference Location :** Amsterdam, Netherlands

**Conference Dates :** May 14-15, 2017