Contribution ID: **723** Type: **Poster**

# Effect of CaCO3 nanoparticles and synthesized ZnO nanoparticles on the properties of natural rubber

*Monday, 21 May 2018 18:30 (15 minutes)*

The effect of the synthesized zinc oxide nanoparticles (sZnO) and calcium carbonate nanoparticles (NCC) on the cure characteristics and mechanical properties of natural rubber were investigated. The sZnO synthesized by microwave assisted aqueous precipitation method using zinc nitrate hexahydrate and sodium hydroxide as a precursor. The morphology of the sZnO is a spherical shape with the average primary size of 46.63 nm and the specific surface area of 38.87 $m^2$ $g^{-1}$. For the NCC is a commercial grade with the average primary size of 66.67 nm and the specific surface area of 28.97 $m^2$ $g^{-1}$. Based on the obtained results, in the unfilled natural rubber, sZnO can be reduced successfully from 5 to 1 phr compared to conventional ZnO (cZnO) and increase tensile strength, 300% modulus and elongation at break by 11%, 9% and 11%, respectively. In case of sZnO and NCC filled with natural rubber, it increases tensile strength, 300% modulus and tear strength by 19%, 19% and 18%, respectively compared to conventional grade (cZnO and CC) in microparticles. This benefit is due to small grain size and large specific surface area of nanoparticles.

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**Session Classification:** A05: Nanoscale and Surface (Poster)

**Track Classification:** Nanoscale Physics and Nanotechnology