

The Potential of Tempo-Oxidized Cellulose Nanofibers to Replace Ethylene-Propylene-Diene Monomer Rubber

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Abstract : In recent years, petroleum-based polymers began to be limited due to the effects on the human and environmental point of view in many countries. Thus, organic-based biodegradable materials have attracted much interest in the composite industry because of environmental concerns. As a result of this, it has been asked that inorganic and petroleum-based materials should be reduced and altered with biodegradable materials. In this point, in this study, it is aimed to investigate the potential of the use of TEMPO (2,2,6,6-tetramethylpiperidine 1-oxyl)-mediated oxidation nano-fibrillated cellulose instead of EPDM (ethylene-propylene-diene monomer) rubber, which is a petroleum-based material. Thus, the exchange of petroleum-based EPDM rubber with organic-based cellulose nanofibers, which are environmentally friendly (green) and biodegradable, will be realized. The effect of tempo-oxidized cellulose nanofibers (TCNF) instead of EPDM rubber was analyzed by rheological, mechanical, chemical, thermal, and aging analyses. The aged surfaces were visually scrutinized, and surface morphological changes were examined via scanning electron microscopy (SEM). The results obtained showed that TEMPO oxidation nano-fibrillated cellulose could be used at an amount of 1.0 and 2.2 phr resulting the values stay within tolerance according to customer standard and without any chemical degradation, crack, color change or staining.

Keywords : EPDM, lignin, green materials, biodegradable fillers

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