Validation of power cable material technology with reduced degassing burden

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Extruded cables with polymeric insulation are commonly crosslinked through the use of radical chemistry initiated by the thermal decomposition of organic peroxides. The byproducts of the crosslinking reaction based upon the use of dicumyl peroxide include cumyl alcohol, acetophenone, alpha-methyl styrene and methane. The “degassing process” for removal of byproducts in high voltage cable often involves the facilitation of the diffusion of byproducts out of the cable through the use of increased temperatures within degassing chambers, while distribution class cables are often allowed to degas under ambient conditions. A reduction in the amount of time necessary to achieve a sufficient level of degassing is viewed as a benefit in the cable manufacturing process.

Using a simple multicomponent diffusion model an estimate can be made for the degree of degassing for various times and temperatures. The model enables parametric prediction of the impact of insulation thickness and temperature on a characteristic diffusion time to achieve a targeted degree of degassing. A protocol has also been established which enables the quantification of the byproduct level within manufactured cables. The model results are compared to the results obtained throughout degassing of a high voltage cable using typical degassing conditions.

Alternate compositions have been developed with an objective to reduce the crosslinking byproducts and thereby reduced the required degassing time. Based upon the diffusion model a 50% reduction in degassing time was expected with the alternative compositions. The alternative composition was utilized for cable extrusion and the byproducts were measured and compared to that of a standard crosslinked polyethylene cable. The results are consistent with the expectation that the alternate composition can deliver a 50% reduction in degassing time, while also delivering an acceptable degree of crosslinking. High voltage cables manufactured with the alternate low-degassing crosslinking technology have successfully completed the Type Test.