The degassing process of HV XLPE cables and its influence on selected electrical properties

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During the manufacturing of peroxide initiated crosslinked polyethylene (XLPE) insulated cables peroxide decomposition products, primarily methane, acetophenone and cumylalcohol, are formed. Degassing of high voltage (HV) and extra high voltage (EHV) XLPE cables is a widely established practice in the industry. The prime reason is to reduce the content of methane due to its flammability and the related hazard. Issues related to potential internal pressure and effect on accessories has also been addressed. The other mentioned decomposition products, polar in nature, have a considerably lower diffusion rate and will remain in the cable over very long times. It is known that these decomposition products have an influence on electrical properties. As their content and distribution is influenced by the degassing process, it is valuable to understand to which extent these properties are modified.

Degassing takes place in special chambers and is a capacity demanding and time consuming process. The planning of the degassing conditions has to take factors such as time, temperature, cable construction and the amount of cables into account. Therefore means of decreasing the degassing time without jeopardizing the technical features of the cables will allow for an optimisation of the overall cable manufacturing process. For this reason the use of a practical calculation model can provide valuable support. This in combination with reliable and specific methods for the analysis of methane would form a basis for cable manufacturers to combine optimised degassing conditions with maintained safe limit of methane.

The diffusion of methane can be numerically modelled. Since the diffusion of methane takes place both during the actual crosslinking process in the continuous vulcanising (CV) line as well as in the subsequent degassing operation it is important to base the diffusion calculation on a combination of these two steps. Today the automation system of most CV lines includes a ‘curing calculation program’ that is used to determine the correct line speed and heating zone profile for a certain cable construction. It is an obvious choice to add a diffusion model as a part of this program for the calculation of methane. This paper presents a model for the calculation of methane in cables and the verification of this model by methane measurements in different HV and EHV cable constructions. It also presents studies on the effects of degassing on the content and distribution of the polar decomposition products and their influence on selected electrical properties.