Thermal Characterization and Modeling of the Temperature of Heating Cables

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The objective of this study is to have a tool for predicting the thermal mapping inside the insulation of an electric cable. These cables are used in the industry for preventing freezing of installations (such as water pipes) and the maintenance of process temperature (as in the oil industry). Cables are made according to the application; and the sizing of the linear power, as well as the thickness of the sheath are critical points. Standardized measurements are done according to standard NF EN 60079-30-1 (or according to Canadian standard C22-2 NO 130-16). The difficulty is to provide the conformity of these cables before they are manufactured. The work consists of measuring the thermophysical properties of the silicones used for the insulation sleeves. The conductivity is measured at a temperature in the range 20 to 200 °C. A test bench has been carried out to measure the surface temperatures of the cables in conditions close to real cases. A modeling program in a finite element method with Cast3M[©] with a Visual-Basic[©] user interface in Excel had been developed. The validity of the model was compared to the experimental values and to the influence parameters such as the convection coefficient in real conditions adjusted for the model to conform to the standardized tests. The results have demonstrated the interest of this type of theoretical study to properly size the heating power and the thickness of insulation to comply with current standards.