

INSULATION BASED ON POLYMER NANOCOMPOSITES IN APPLICATION TO LOW-VOLTAGE ELECTRICAL MOTORS

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ABSTRACT

The purpose of this work was presentation the proposition of solving a problem concern in the insulation of low-voltage motors driven by inverters with application of polymer nanocomposites. The work comprises the survey of insulating materials used in a low-voltage insulating system and description of problems with turn-to-turn insulation in inverter-driven motors, as well as current methods of solving them. Historical outline of the development of electrical motors, electroinsulating material based on organic materials, insulation of low-voltage motors and power electronic are also presented. Types and properties of polymer nanocomposites, methods of their production as well the present and future applications (in particular electroinsulating materials) have been described. The results of the own investigation of the conventional enamelled wires resistance to stresses induced by the PWM inverters have been presented. Moreover, the methods of obtaining NLPE nanocomposited enamels for winding wires have been used. The aforementioned method was developed with the participation of the author. The results of many years of author investigations in the domain of NLN nanocomposited impregnating varnishes are shown and discussed. It was stated in summary that NLPE and NLN varnishes, that create turn-to-turn insulation, show better properties in comparison to conventional varnishes. It concerns especially to the multiple higher resistance to partial discharges that appear under inverter pulse voltage. It was shown that the improvement of many properties in nanocomposites can be explained through the barrier properties. Methods of analysis of polymer nanocomposites properties have been also proposed. Application of polymer nanocomposites in inverter-driven low-voltage motors should contribute to increase of their durability. It will allow to avoid the denomination of parameters of the electrical motors in the future.

Keywords: *squirrel electrical motor, low-voltage insulation system, turn-to-turn insulation, PWM inverter, enameled wire, impregnating varnish, polymer nanocomposite, partial discharges resistance*