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NUMERICAL STUDY OF TEMPERATURE FIELD DURING COMPOSITE CASE CO-CURING PROCESS

Abstract

The motor case for modern SRM is a complex compose structure with fiber reinforced resin matrix composite, EPDM insulation and metal connections, the case forming process is a co-curing process including resin curing and rubber vulcanizing, which involving heat transfer, chemical reaction and structure deformation. During the co-curing process, temperature determines whether the case curing completely and the uniformity of temperature field is an important factor in causing residual thermal stress and shrinkage stress, so temperature field is the key to the mutual coupling effect of each physical and chemical process, and the basis to analyze the co-curing process of the case. In order to investigate the influences of processing parameters on the temperature field of co-curing process, a co-curing simulation model was built for a simplified composite SRM case firstly, and the model was verified. Then ,the dimensionless form of heat transfer equation and curing kinetics equations about composite case were obtained by dimensional analysis. Finally, the influence rules of curing cycle, convection heat transfer coefficient and thermally physical parameters on the temperature field of the case during the co-curing process were quantitatively analyzed by numerical simulation. The results show that the curing cycle and the convection heat transfer coefficient have significant effect on the temperature field. lower heating rate and extend holding time can improve the uniformity of temperature field under the condition that amplifications of each sub- cycle are constant. While the heat transfer coefficient increase, the temperature of the case can be improved effectively under the same curing cycle and the vulcanization of EPDM insulation also can be improved.