Comparative Evaluation of the Loss and Thermal Performance of Advanced Three Level Inverter Topologies

This paper presents a comparative evaluation of the loss and thermal performance of two advanced three-level inverter topologies, namely the partial SiC T-Type and the Hybrid-NPC, both of which are aimed at reducing the high switching losses associated with a conventional Si T-Type inverter. The first solution directly replaces the 1200V primary Si IGBT switches with lower loss 1200V SiC MOSFETs. The second solution strategically adds 600V CoolMOS FET devices to the conventional Si T-Type inverter to reduce the primary commutation losses. Semiconductor loss models, experimentally verified on calibrated heat sinks, are used to show that both variations can significantly reduce the semiconductor losses compared to the Si T-Type inverter. The results show that both alternatives are attractive if high efficiencies and reduced thermal stress are major requirements for the converter design.