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# High-efficiency interior-type PM motor design for urban use electric vehicles

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An electric motor is the most important component that determines vehicle performance in electric vehicles. DC motors, switched reluctance motors, asynchronous motors, and synchronous motors are used as drive motors in electric vehicles. Rare-earth magnets can be used in industrial applications that require low volume and weight. These types of magnets allow using magnets with a lower volume due to the high energy product. With regard to performance, permanent magnet motors are preferred, especially in electric vehicles, due to their high efficiency and power density advantage. Since the vehicle constantly stops and starts, especially in urban transportation, its performance depends on the engine performance. Considering this situation, 50 kW interior permanent magnet synchronous motor was designed in this study. The rotor of the designed motor has a V-shaped magnet. Since the rotor has no winding, no copper loss occurs in the rotor, which leads the motor to have high efficiency. The geometric dimensions and material properties of the rotor magnets were determined as variables, and the motor performance was analyzed using the finite element method. An N40-UH type was preferred as a magnet in the rotor to obtain high torque at a low volume. Magnet thickness and magnet width were defined as variables, and as a result of parametric analyses, the highest efficiency was achieved as 94.77% when the magnet thickness was 6 mm and the magnet width was 36 mm.

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