

KAWASAKI STEEL TECHNICAL REPORT

No.39 (October 1998)

Electrical Steel

Effects of Core Materials on Efficiency of Inverter Drive Motor

Atsuhito Honda, Keiji Sato, Isamu Ohyama

Synopsis :

Properties of a 3-phase 6-pole 400 W inverter drive motor, using 6 kinds of non-oriented Si steel sheets as stator core materials, were investigated. PWM (pulse width modulation) inverter wave frequency was changed from 30 to 300 Hz and a frequency of 40 times of the fundamental inverter frequency was adopted as the carrier wave. It was found that the effect of Si content on motor efficiency is small when the PWM frequency is low, while when the PWM frequency is high, the motor efficiency rises as Si content of the core material increases. There exists an optimum Si content of the material depending on the design of the flux density of a motor. Both reduction in the thickness of material and stress relief annealing of stator cores also improve the motor efficiency.

(c)JFE Steel Corporation, 2003

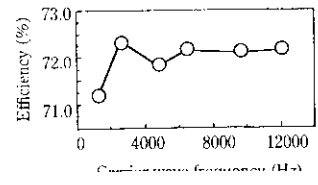
The body can be viewed from the next page.

Effects of Core Materials on Efficiency of Inverter Drive Motor*



Synopsis:

Properties of a 3-phase 6-pole 400 W inverter drive motor, using 6 kinds of non-oriented Si steel sheets as stator core materials, were investigated. PWM (pulse width modulation) inverter wave frequency was changed



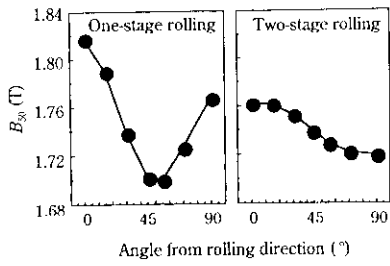


Fig. 3 Anisotropy of non-oriented Si steel sheets

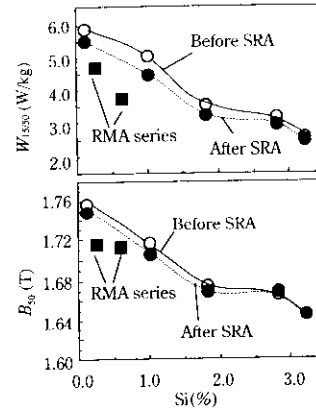
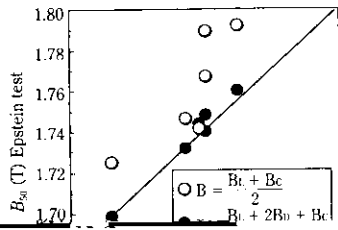


Fig. 5 Effects of Si content and stress relief annealing (SRA) on material characteristics

JIS grade material expressed by open circles, Si reduces

spective of stress relief annealing, motor efficiency tends to decrease with the excitation frequency in the lower frequency region. There is little influence of the Si content of the material in the lower frequency region. In

restrained at intermediate rotation speed of 1200 rpm (PMW frequency: 60 Hz). This is because iron loss change in this region is compensated by the change of copper loss, though the copper loss is dominant as

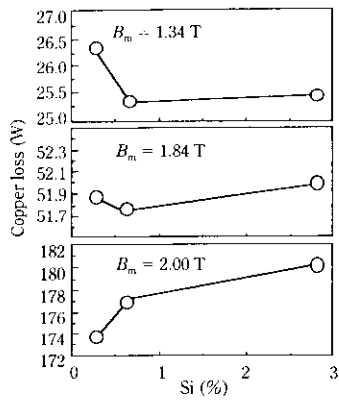


Fig. 9 Effect of design flux density B_m on copper loss of motor

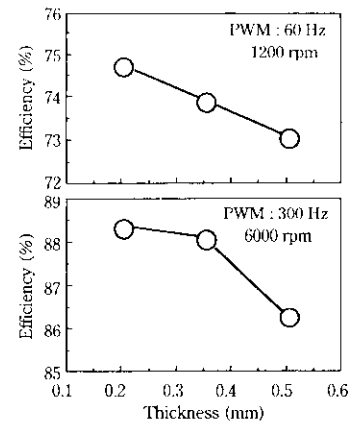
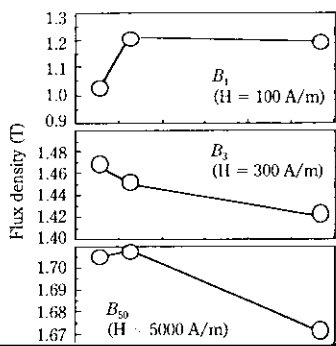


Fig. 11 Effect of material thickness on motor efficiency (1.8%Si steel)



4 Conclusion

The influence of core material magnetic properties, iron loss, sheet thickness, and stress relief annealing on the efficiency, iron loss and copper loss of 3-phase 6-pole 400 W inverter drive motors was investigated, with the following results.

- (1) The effect of material Si content on the motor efficiency was small when PWM frequency and rotation speed were low.

(2) The efficiency increased with Si content at a fixed