KAWASAKI STEEL TECHNICAL REPORT
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Electrical Steel

Effects of Core Materials on E fficiency of Invert er Drive Motor

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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 material s, were investigated. PWM (pulse width modulation) inverter wave fr equency was changed from 30 to 300 Hz and a frequency of 40 times of the fundamental inverter frequenc y 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 redu ction in the thickness of material and stress relief annealing of stat or cores also improve the motor efficiency.

The body can be viewed from the next page.

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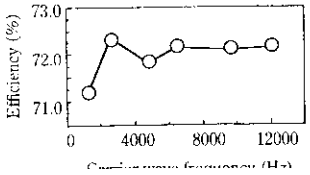

73.0
72.0
71.0
Efficiency (%)
0
4000
8000
12000

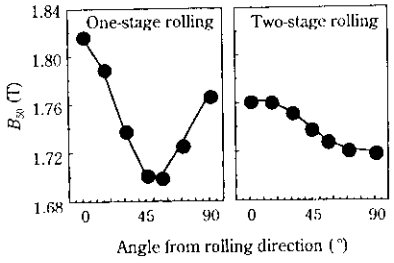
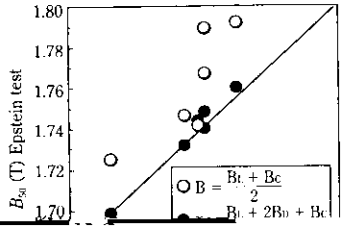


Fig. 3 Anisotropy of non-oriented Si steel sheets



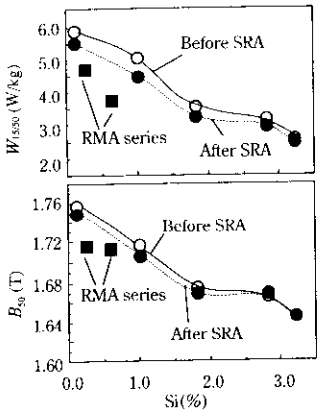


Fig. 5 Effects of Si content and stress relief annealing (SRA) on material characteristics

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 1 200 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

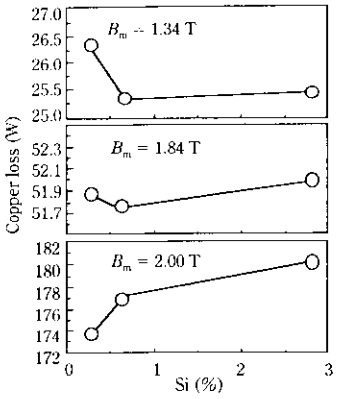


Fig. 9 Effect of design flux density B_m on copper loss of motor

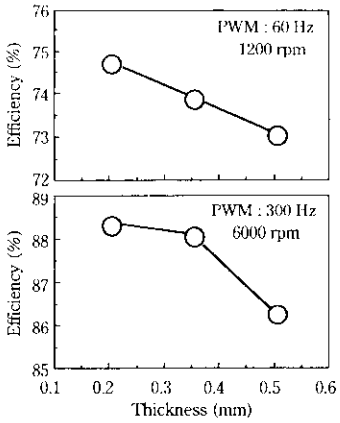
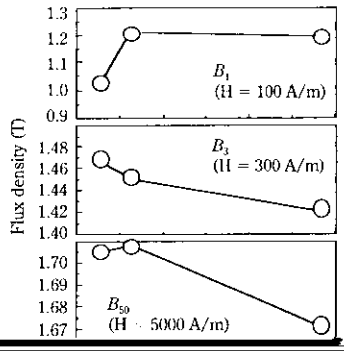


Fig. 11 Effect of material thickness on motor efficiency (1.8%Si steel)



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 rotarion speed were low.

(2) The efficiency increased with Si content to a high