Evaluation of microstructures of variously heat treated carbon steel by magnetic coercivity measurement

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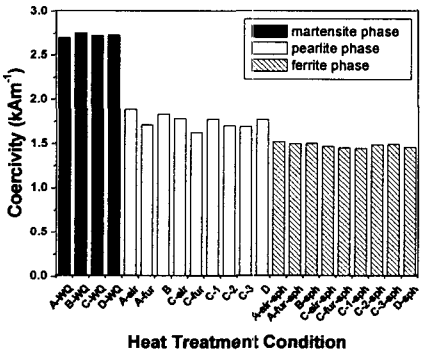
The microstructures of variously heat treated carbon steels with different carbon content (0.45% and 0.85%) were evaluated by magnetic coercivity measurement. Isothermal transformation, continuous cooling or spheroidization heat treatment was performed to produce various microstructures. Microstructural parameters (phase, pearlite interlamellar spacing, grain size and morphological parameters of carbides (spheroidization, size, number density and aspect ratio)) and magnetic coercivity were measured to investigate the relationships between them. Coercivity was observed to be high in order of martensite, pearlite and ferrite phase as shown in Fig. 1. The high coercivity in martensite phase was attributed to the stress field due to dislocations in martensite laths and plates. The linear decrease of coercivity with the increasing pearlite interlamellar spacing was found (Fig. 2). This result was attributed to the residual stress field arising between ferrite matrix and mismatched cementite lamellar. The degree of spheroidization of carbides had little effect on the measured coercivity. Therefore, magnetic coercivity was suggested as a potential nondestructive evaluation parameter for assessing the microstructures (pearlite interlamellar spacing and phase) of carbon steels.

References

[1] D. W. Kim and D. Kwon, J. Magn. Magn. Mater., 257, 175 (2003)
[2] H. Sakamoto, M. Okada and M. Homma, IEEE Tran. Mag., 23, 2236 (1987)



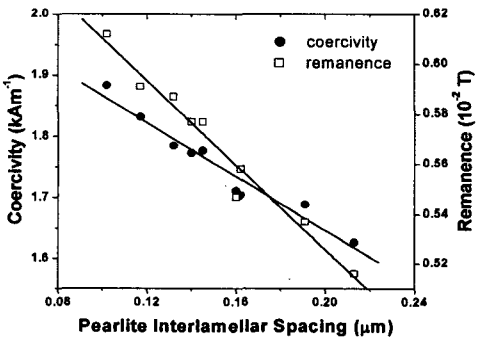


Fig. 1. Chagne of magnetic coercivity with heat treatment condition.
Fig. 2. Chagne of magnetic coercivity with increasing pearlite interlamellar spacing.