# Evaluation of thermal degradation of 2.25Cr-1Mo steel by Magnetic Barkhausen noise

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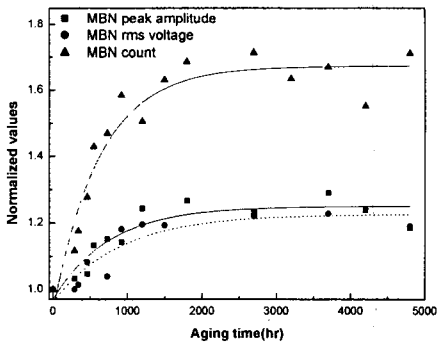
The 2.25Cr-1Mo steel has been widely used for high temperature structure applications. However, this steel is known to result in aging degradation due to temper embrittlement and carbide induced brittleness after long time exposure to high temperature. In this research, an attempt was made to evaluate the degree of aging degradation in 2.25Cr-1Mo steel by magnetic Barkhausen noise (MBN) technique [1,2]. Artificial aging was performed to simulate the microstructural degradation in 2.25Cr-1Mo steel arising from long time exposure at high temperature. Microstructural analysis (size and number of carbides per unit area), measurement of mechanical properties (Vickers hardness, UTS, and ductile-brittle transition temperature) and Barkhausen noise analysis (MBN rms voltage, MBN count, peak voltage, and frequency spectrum) were carried out to investigate the mutual relationships. The MBN rms voltage and MBN count were observed to increase rapidly in the initial 1000 hours of aging time and then change little thereafter as shown in Fig. 1. Linear correlations between the mechanical properties and MBN parameters in thermally degraded 2.25Cr-1Mo steel were observed as shown in Fig. 2. MBN was suggested as a potential nondestructive evaluation parameter for assessing the thermally degraded microstructures and mechanical properties of the 2.25Cr-1Mo steel.

## References

[1] V. Moorthy, S. Vaidyanathan, and T. Jayakumar, J. Magn. Magn. Mater., 171, 179 (1997)
[2] C. C. H. Lo, J. P. Jakubovics, and C. B. Scruby, J. Apply. Phys., 81, 4069 (1997)



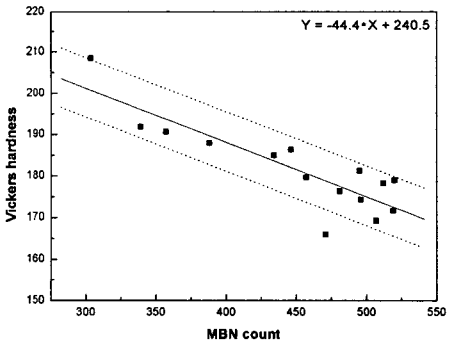




Fig. 1. Chagne of magnetic Barkhausen noise parameters (count, peak amplitude, and rms voltage) with increasing thermal degradation time.
Fig. 2. Correlation between magnetic Barkhausen noise count and Vickers hardness of thermally degraded 2.25Cr-1Mo steel.