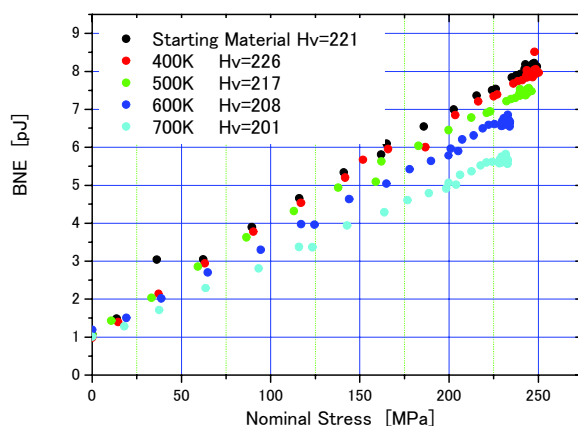


THE EFFECT OF MECHANICAL STRESS ON BARKHAUSEN NOISE FROM HEAT-TREATED PERMALLOY PLATES

H. Nishihara, K. Kojima, S. Taniguchi, H. Maeda, T. Sagae, M. Harada,
T. Ogino, S. Matsumoto, Y. Shindo and N. Ohtsuka
Faculty of Science and Technology, Ryukoku University,
Seta-oecho 1, Otsu 520-2194, Japan

When varying magnetic field is applied to a ferromagnetic material, the magnetization shows discontinuous change due to discontinuous domain wall motion which induces magnetic Barkhausen noise in a pickup coil. The magnetic Barkhausen noise measurements have been reported and discussed in relation to heat treatment, grain size, strain, and hardness [1]. However, still a mechanism of the generation of the Barkhausen noise has not been well understood and the measurements are not established as a popular method for non-destructive test (NDT). We pick up 45-permalloy plate which is a magnetically soft ferromagnet, and report here an experimental study on the effect of mechanical stress on Barkhausen noise from rolled thin plates. The effect has also examined for the plates which are annealed at various temperatures. The Barkhausen noise energy (BNE), which is defined as the total energy integrated over a single sweep of applied field for a 10 k Ω load on a detecting coil, is shown in the figure below as a function of nominal stress for annealed thin permalloy plates at various temperatures. The Barkhausen noise energy has been found a linear relation with nominal stress. This result is similar to a reported result for XC10 French steel [2], but quite different from cases of high carbon steel cables and pure nickel plate [3, 4]. These behaviors are interpreted with our newly proposed model of "existing of preferable conditions for Barkhausen noise observation" [4].



- [1] See, for a review, O. Sundstrom and K. Torronen, *Materials Evaluation* **37** (1979) 311, D.C. Jiles, *NDT International* **21** (1988) 311.
- [2] M.J. Sablik and B. Augustyniak, *J. Appl. Phys.* **79** (1996) 963.
- [3] R. Rautiaho, J. Kivimaa and M. Moilanen, *J. Mag. Mag. Mater.* **129** (1994) 217.
- [4] H. Nishihara, S. Taniguchi, H. Maeda, I. Oguro, M. Harada, T. Ogino, S. Matsumoto, Y. Shindo, and N. Ohtsuka, *Proceedings (CD-ROM) for 12th Asia-Pacific Conference on Non-Destructive Testing 2006* (Auckland, New Zealand).