Assessment of the technical condition of high-strength steel structures using the Barkhausen noise method

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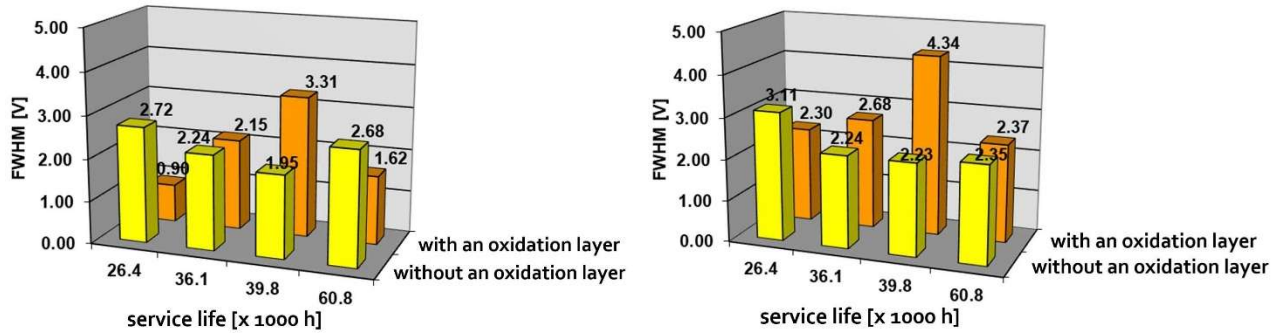
In this work, the magnetic Barkhausen noise method will be presented as a tool for assessing the service life of structural components. The presented article extends the author's previous research on the application of Barkhausen noise in the diagnostics of structural material degradation [1, 2], as well as in the assessment of microstructural quality and mechanical properties of manufactured components [3].

The blades working under identical operation parameters were cut from four steam turbines that were taken out of service after various periods of exploitation. The operating times of the blades were 26 400 h, 39 800 h, 36 100 h, and 60 800 h. Barkhausen noise measurements were performed on the trailing edge and the leading edge of the blades before and after removing the oxide layer. The results of such tests are presented in Fig. 1.



(a) trailing edge (b) leading edge

Figure 1. Full width at half maximum (FWHM) of the effective Barkhausen noise voltage envelope in relation to the service life of the turbine blade

The FWHM parameter clearly changed for both the trailing and leading edges of the blades as their service time increased. These relationships were observed for specimens with the oxide layer and without it.

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[1] K. Makowska, T. Szymczak, Z.L. Kowalewski, Acta Mech. Autom. 18(1), 40–47, 2024. https://doi.org/10.2478/ama-2024-0005

[2] K. Makowska, T. Szymczak, Z.L. Kowalewski, J. Theor. Appl. Mech. 63(3), 657–672, 2025.https://doi.org/10.15632/jtam-pl/205163

[3] K. Makowska, Z.L. Kowalewski, J. Theor. Appl. Mech. 62, 2024. https://doi.org/10.15632/jtam-pl/191444