4.2.21. COERCIVITY OF A THERMOSTRENGTHENED STEEL 14H17N2 AFTER FORGING AND REPEATED LOADING

Matsevityi V.M., Institute of machine construction in the name of A.N. Podgornyi of NAS of Ukraine, Kharkov, Ukraine;
Bezlyudko G.Ya., C.E., Special Scientific Engineering Company, Kharkov, Ukraine

This paper is a link of the study, relative to setting of the coercivity-metering (c.m.) field inspection of the fatigue state and life time of steels of the power utilities equipment on the thermal and nuclear power plants. The similar task in the context of low-carbon constructional steels of wide application is already successfully resolved in ordinary diagnostics. Here metal starts to work, as a rule, in a state as delivered from metallurgical plant, with a low-distorted crystal structure, low-level strength and the significant reserve of plastic properties. Depending on the grade, the coercivity of such steels increases by 100–400 % during degradation from an initial state to that of pre-destruction.

In order to estimate the potential of c.m. monitoring of structural condition of thermostrengthened heat-resistant steels of the power utilities' equipment, the following outcomes were obtained on the specimens of steel 14H17N2 steel.

1. The coercivity Hc of heat-treated steel (thermohardening + high-temperature tempering) after a forging became essentially decreased as a result of healing the submicrolack of adhesions and progressing of dynamic rest processes.

2. During a repeated loading the coercivity at the beginning promptly grows with increasing of the number of cycles and of load magnitude. With further increasing of the number of cycles the coercivity reaches its peak, then decreases. Breakage occur at large magnitudes whereas at small magnitude the breakage can occurs after 106 or 107 cycles or cannot occur at all.

3. Increase of Hc at a metal repeated loading after its improving here can be related to accumulation of subcrazes, and also to hardening of the metal segments which are free of breakage elements. Subsequent decrease of Hc (after reaching a maximum) can be related to development of dynamic rest processes and of microbreakage.

The obtained characteristic and magnitudes of Hc variations at a repeated loading indicates to an effectiveness of a coercivity metering for a practical assessment of the metal microdamages for similar specific grades during field inspection of the fatigue state and of the equipment service life on the thermal and nuclear power plants together with or instead of a replica technique applied now, as more expensive and more local.

In this report the results of real tests are presented.