4.2.13. TESTING OF PHASE COMPOSITION, HARDNESS AND WEAR RESISTANCE OF HIGH-CHROMIUM STEELS WITH NITROGEN AND CARBON CONTENT BY ELECTROMAGNETIC METHODS

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Elaboration of steels with over equilibrium nitrogen content is the prospective direction in creation of alloyed in saving manner, high-strength, wear and corrosion resistant materials. Casting technology with nitrogen counter-pressure allows completely non-ferromagnetic structure to be formed in steels based on the Fe-Cr-N system without usage of nickel and manganese for the account of introduction of nitrogen being the strong austenite-forming element. Paper studies phase composition, hardness, abrasive resistance and electromagnetic properties of two high-nitrogen steels produced under the method of casting with counter-pressure: C18A1.0 cast steel (wt. %: 1.00 N; 0.07 C; 19.02 Cr; 0.17 Mn) and C22GA1.24 hot-deformed steel (wt. %: 1.24 N; 0.07 C; 22.2 Cr; 1.38 Mn).

For comparison, 95C18 industrial carbon-containing steel (1.00 C; 17.72 Cr; 0.48 Mn) was studied. With variation of quenching temperature within the range of 950–1.200 °C, non-monotonous (with maximum) variation of strength and abrasive wear resistance of discussed high-chromium steels is established. Increasing in quantity of feebly magnetic γ-phase observed as quenching temperature increases causes the continuous growth of coercive force and saturation magnetization, as well as continuous decreasing of residual induction, maximal magnetic permeability and informative parameters of electromagnetic-acoustic conversion (EMAC) like amplitude of resonance signal and velocity of zero mode of longitudinal normal acoustic wave. Above stated physical characteristics can be used as parameters for testing the phase composition of high-chromium steels containing nitrogen and carbon and the quality of their quenching within the wide range of austenization temperatures. For steels with nitrogen content, higher sensitivity of the EMAC resonance signal amplitude to phase composition is noted as compared with 95C18 steel.

Possibility of the eddy-current method application for evaluation of phase composition, strength and abrasive wear resistance of high-chromium and carbon-containing steels was demonstrated.

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