4.2.14. EDDY-CURRENT TESTING OF LASER-HARDENED CEMENTED CHROME-NICKEL STEEL FOR DRILL BITS

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Features of eddy-current testing of 20CN3A cemented chromium-nickel steel subjected to treatment by continuous laser radiation, subsequent cold treatment at –196°C (decreasing the amount of residual austenite in the cemented layer fro 25–40 to 5–10 vol.%) and tempering within the temperature range of 100–400°C were studied. It is demonstrated that eddy-current method can be used for detection of laser-hardened wear resistant layer on a surface, as well as for evaluation of abrupt reduction of abrasive wear resistance of steel hardened by laser and additionally treated by cold following backing. With application of superposed probe with protruding ferrite core possessing with increased localization, high sensitivity of eddy-current method to structural modifications occurring in the laser-hardened cemented steel during cold treatment and tempering at temperatures of up to 250–300 °C is revealed. For roller path of journals of drilling bit legs of 20CN3A steel, possibility of eddy-current testing of the quality of laser hardening increasing cemented layer resistance to contact fatigue and abrasive wear is established.

Superposed probe with protruding rod core makes it possible to detect sections with optimal and reduced (underheating) depth of the laser hardening zone, sections with zones of laser tempering (strong underheating with absence of hardening) and zones of partial melting (overheating during laser treatment) on the curvilinear surfaces of roller and ball races. It is reasonable to carry out eddy-current testing of drill bits using electromagnetic field frequency, when the depth of analyzed layer corresponds approximately with optimal thickness of laser gardening layer.

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