Study of the Structure and Mechanical Properties of Engineering Products Using the Metal Magnetic Memory Method

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In conditions of metallurgical and technological processes during blanks and engineering products manufacture of two-phase austenitic-martensitic class steels, the problem of uncontrolled (or spontaneous) transition in local zones of austenitic structure to martensite occurs with carbides release. This problem occurs especially often during the thermal and deformation processing and welding of these steels. When inspecting the quality of products made of these steels, the problem of detecting the local zones of the martensitic phase and carbides precipitation in the product metal arises, respectively. In many cases, it is unknown where these zones are located and how they can be detected. Due to the large difference in austenite and martensite densities, stress concentration occurs at their boundaries. Studies have established that the magnetic metal memory (MMM) method is an efficient non-destructive testing (NDT) method for detecting local stress concentration zones (SCZs). The MMM method differs fundamentally from all the known magnetic NDT methods by the fact that its application does not require artificial magnetization of a product, but it uses the natural magnetization formed during the metal cooling below the Curie point in a geomagnetic field. In the course of experimental studies, it was found that magnetic anomalies occur in local SCZs of products made of the considered steel, which are characterized by high values of self-magnetic stray fields (SMSF). During the inspection by the MMM method, magnetometric scanning devices record SMSFs on the products surface. The paper considers the experience of the MMM method application in the study of the causes of damage of centrifugal compressor impellers, small diameter tubes and other products made of austenitic steel.