The most promising is combined pressing, which provides high density and production strength of the blanks. The density of the blanks after solid-phase sintering is sufficiently high for high-frequency induction heating for subsequent hot plastic deformation to be done in air.

Therefore combined pressing of high-speed steel powders including static and impact pressing with subsequent solid-phase sintering at 1180-1200°C provides obtaining of high-density blanks with a fine-grained structure and a uniformly distributed carbide constituent.

LITERATURE CITED


HARDENABILITY OF SP70DZ-1 P/M STEEL IN RELATION TO CARBON CONTENT IN IT

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The production of sintered constructional parts of hardenable SP70DZ-1 P/M steel has found wide use. According to procurement specifications as a rule the carbon content in the steel after sintering is 0.5 ± 0.2% [1], that is, its allowable carbon range is 0.3-0.7%. Therefore determination of the influence of carbon within these limits on the hardenability of SP70DZ-1 steel is very important for establishment of the hardening cycles and prediction of the structure and properties of the steel obtained subsequently.

Specimens of steel with a porosity of 15-17% containing 0.3 ± 0.05 (SP30DZ-1), 0.5 ± 0.05 (SP50DZ-1), and 0.7 ± 0.05% C (SP70DZ-1) were investigated. The original materials were PZh2M2 iron [2], PMS-1 copper [3], and GK-2 graphite [4] powders. Zinc stearate was used as the plasticizing addition [5].

To decrease the quantity of oxygen the iron powder was annealed in an atmosphere of dissociated ammonia at 1073 ± 20 K and held for 3600 sec, as the result of which the oxygen content after annealing was not more than 0.05%. The sponge obtained after reduction annealing was ground in a type LDM-1 grinder and sifted through an 016 sieve [6]. The charges for preparation of the experimental lots of parts were mixed for 6 h in a 915FPN cone mixer with a capacity of 15 kg. Five samples were taken to determine the chemical analysis and quality of mixing. The charge was assumed to be ready if the deviation in carbon and copper did not exceed 0.05%. The specimens were produced by single pressing under a pressure of 700
Fig. 1. Thermokinetic curves of sintered SP70DZ-1 steel with a density of 6,600 kg/m³. Carbon content, %: a) 0.3; b) 0.5; c) 0.7.

MPa. The sintering was done in an SN2.6.12.4/12 electric furnace at 1523 K for 4 h in a dissociated ammonia atmosphere with a dew point of 233 K. To prevent decarburization a filler of 15 alumina [7] containing 0.6% GP-1 foundry graphite was used [8]. The density of the specimens after sintering was determined by the hydrostatic method [9]. The oxygen content in the specimens after sintering did not exceed 0.20%.

The kinetics of decompositon of the austenite in continuous cooling were investigated and the thermokinetic curves were constructed on a quick-acting magnetometer with permanent magnets [10, 11]. The size of the specimens for magnetometric measurements was 2 × 10 × 50 mm. The specimens were austenitized at 1143 K for 600 sec.

The hardenability was calculated from the data of the thermokinetic curves. Mathematical simulation of the process of hardening of an end-quench specimen was used for this purpose. The nonlinear equation of thermal conductivity with boundary conditions of the third kind served as the mathematical model [12]. It was solved by the method of finite difference schemes on an ES 10-20 computer.

Investigating the rules of austenite transformation in continuous cooling, after austenizing the magnetometric specimens were quenched in argon at rates of 2-40 deg/sec, in oil of 75-100, and in water of 500-550 deg/sec. For each quenching rate the temperature of the start of finish of decomposition of austenite was determined. The time corresponding to 0.5% decomposition of austenite was taken as the start of the transformation and that to 99% as the finish. The thermokinetic curves were drawn on the basis of the data recorded on the magnetometer (Fig. 1).