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Structure-phase states of the nickel surface layers after electroexplosive carburizing

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The layer by layer study of the structure-phase states of the nickel surface layer carburizing with use the phenomena of the electrical explosion has conducted by the method TEM of the fine foils. The efficient meaning of absorbed power density is formed 7.6×10^5 W/cm^2, the time of the irradiation -100 μs, the modified depth of alloying layer reached 33 μm. The surface layer, as well as layers, located at the depth of 1.5 μm and 30 μm, have been analyzed.

It is shown that the forming when processing structure had brightly denominated gradient nature. Nanosized particles of the graphite on surfaces formed the film, but in volume layer were situated on defects of the crystalline structure of the nickel. As far as removing from surface of the irradiation the state of base changed from nanocristalline (the solid solution of carbon in nickel) to coarse grained and highly strained, containing particles of the graphite in surface layer and particles of the nickel carbide in layer of 25 μm—30 μm depth not far from boundaries of the zone alloying with matrix. In surface layer, located at the 1 μm depth, the areas of the material with 5—10 μm size, having brightly expressed two phase structure, organized on principle of the microduplex system are found. It was presented by globules of the solid solution of carbon in nickel with average size 0.23 μm and layer of the graphite, which thickness changed within 0.05—0.15 μm. It is possible to expect that they were formed as a result of high rate dissolution of the particles of coal-graphite filaments and the following crystallization at self-quenching as a result of heat removal into the sample when the balancing diffusion time is essentially restricted. In the volume of grains the net-like or chaotic dislocation substructure are existed. The scalar dislocation density reached 4×10^{10} cm^{-2}. Near the boundary of the zone alloying with matrix the essential refining of the grain structures of the nickel was discovered. The strong strain hardening of nickel in this area was conditioned by high level of thermoelastic stresses, caused by gradient of the temperature field. In consequence of high temperature and large time of cooling the recrystallization of the crystallized structure began in these places.

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