solid solution zones is more gradual after sintering in hydrogen than after sintering in endogas. After sintering in a vacuum an additional transition zone is observed, characterized by a different value of microhardness. Thus, with materials intended for parts operating under shock load conditions an attempt should be made to obtain homogeneous structures.

CONCLUSIONS

1. A study was made of the dynamic strength of some sintered constructional steels with alloying additions. It is shown that these materials can successfully operate under repeated impact loading conditions even when they have low impact strength.

2. The impact resistance properties of a material are markedly affected not only by its chemical composition but also by its microstructure, which in turn depends on the nature of the sintering atmosphere used.

3. The dynamic strength of sintered constructional materials can best be assessed by subjecting them to impact tests in which oscillographic records are obtained of the fracture process and, additionally, to impact fatigue tests.

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EFFECT OF TEMPERATURE AND LOADING RATE ON THE PROCESS OF DEFORMATION OF SINTERED COPPER AND COPPER WITH Al2O3 IN AIR

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At present a great deal of investigational work is being conducted on materials combining good heat resistance with special thermophysical properties. Of particular interest among materials of this class are copper-base dispersion-hardened alloys, which find their application mainly in the welding and electrical industries (as electrodes for spot, resistance, and other types of welding, current terminals, contacts, and the like).

The process by which parts can be produced from such materials and their heat resistance and special properties depend to a large extent on the conditions under which the starting pre-pressed and sintered (or unsintered) billets are hot-worked. However, in order to be able to choose the most appropriate method of plastic working for such billets, which are as a rule characterized by poor ductility, it is necessary to know


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how their strength and ductility characteristics are affected by temperature and deformation rate. An important point to bear in mind in this connection is that the billets must be fully protected against oxidation. Many of the methods of heating used in industry do not meet this requirement. Thus, e.g., heating in protective environments (argon, molten glasses and salts, etc.) does not prevent oxidation of pressed billets because of the presence of atmospheric oxygen in their pores. On the other hand, nonoxidizing heating in evacuated containers presents considerable technical difficulties and is impractical from the standpoint of time economy, and is therefore not suited for production under industrial conditions.

Oxidation alters the strength and ductility characteristics of billets, and must therefore affect the choice of specific processing conditions and the properties of the end product. In the present work a study was made of the effect of temperature and loading rate during the heating of specimens in air, i.e., under conditions similar to those encountered in practice, on the deformation resistance and ductility of sintered materials ($\sigma_t$ and $\delta_{th}$, respectively). The object of the study was to determine those temperature ranges in which this influence can be neglected, enabling the experimental data obtained to be employed for rationally choosing suitable hot-working conditions.

Uniaxial compression tests were carried out on specimens of 10 ± 0.05-mm diameter and height, produced by pressing from PMS-2 electrolytic copper powder with and without grade "ch, d, a," ("pure for analysis") alumina powder additions. For the preparation of pure copper specimens the copper powder was comminuted in an M-10 vibratory ball mill. Copper-$Al_2O_3$ specimens were produced from mixtures obtained by simultaneously comminuting the copper and alumina powders (the latter being first precomminuted for 1.5 h). Milling time for all compositions was 1.5 h. The specimens were sintered for 2 h in a hydrogen atmosphere at a temperature of 950°C, pressed, and machined to the dimensions mentioned above. They were then annealed for 1 h in a hydrogen atmosphere at a temperature of 600°C to remove the effects of work-hardening. The specimen porosity after sintering was 24 ± 1%.

Compressive tests were carried out on specimens in a UMM-10 laboratory press and an F1232 frictional press, at rates of strain of 0.01 m/min and 1.0 m/sec, respectively. The heating of the specimens was performed in air, using, in the former case, a special tubular heater mounted on the press columns (the testing remained constant in the course of deformation) and, in the latter case, a muffle furnace. The specimens were then transferred in a special device preheated to the testing temperature onto the press block. In both cases the heating temperature was measured with a contact thermocouple. Upsetting was continued until visually detectable cracks appeared on the side surfaces of the specimens. In tests in the frictional press upsetting was