1) definition of theoretical and methodological principles for unifying medical instruments;
2) definition of new or revision of existing method statements on the unification of medical instruments; and
3) creation of a unification service in the speciality.

Only certain aspects of the unification of medical instruments have been considered here. It is necessary also to examine the unification of technological processes, technological equipment, and so on. Only an all-around approach to unification will provide the best effect.

LITERATURE CITED

5. All-Union State Standard 23945.0-80: Unification of Components: Basic Concepts [in Russian].
7. All-Union Conference on Unification and Aggregation in Engineering: Resolutions [in Russian], Moscow (1976).
8. All-Union State Standard 23945.1-80: Component Unification: Basic Specifications for the Definition (Selection) of a Base Component [in Russian].

LAWS OF CHANGE IN THE COMPOSITION AND STRUCTURE OF METAL NEAR THE WELDED JOINT OF WORK PIECES FOR DENTAL DRILLS


UDC 615.472.3.03:616.314-089.877:615.465

The composition and structure of the metal in the region of the welded joint that connects the tip of dental drills, which is made of type VK-6 hard alloy (tungsten carbide – 94% and cobalt – 6%), with the shank, which is made of chromium stainless steel type 20Kh13, determines to a significant degree its strength characteristics and thus the service life of the drills.

The distribution of the structural elements and the variation of the phase composition in the weld region is undoubtedly of scientific and practical interest and therefore was the object of our studies.

The distribution of the Fe, W, and Co elements near the welded joint was studied with a type MS-46 x-ray microanalyzer while moving the electron probe steadily in a direction perpendicular to the interface between the hard alloy and the steel.

The measuring error for the average value of intensity (the concentration of the elements) in a confidence interval of 0.95 was ±3% (as obtained on five tests). At the same time radiographic examinations were made of the phase composition in the welded regions obtained by mechanically fracturing the welded workpiece of the drill. Radiographs were obtained from the fracture surfaces in the type 20Kh13 steel and the type VK-6 alloy and also...
from deeper layers after grinding various portions of the fractured drill by using a type DRON-2 x-ray diffractometer with a voltage of 30 kV on the tube and an anode current of 20 mA while turning the counter at a rate of two degrees per minute.

Figure 1 shows curves for concentration measurements of Fe, W, and Co in the cross section of the welded joint. As may be seen, the results of the welding is a mutual penetration (diffusion) of elements of the alloy W and Co into the steel and of Fe from the steel into the hard alloy. This indicated by the gradual change of the concentration for Fe and Co in the welding region. W penetrates the steel to a depth of 15-20 μm; its concentration here remains practically unchanged with respect to that in the hard alloy. The total width of the transition layer (the diffusion region) is 150 μm. The layer can be arbitrarily divided into two regions. The first region has a width of 130-140 μm, it adjoins the hard alloy, it is characterized by a constant average concentration of W, by a smooth increase towards the steel of the concentration of Fe, and by a smooth decrease in this same direction of the concentration of Co. The deviations to smaller and greater values from the average concentrations of Co and W indicate the existence in the VK-6 alloy and the first region of a transition layer for the phases with an increasing and decreasing content of these elements, i.e., of the tungsten carbide (the region with an increasing concentration of W) and of the cobalt compound (surges in the curve for Co and minima in the curve for W).

The second region, which has a width of 15-20 μm, adjoins the steel. The concentration of W here is maintained the same as in the hard alloy; the concentration of Co is substantially lower and decreases smoothly to zero at the boundary with the steel. The concentration of Fe in the second region, on the average, is the same as in the steel except for one dip at a in the curve (see Fig. 1); at the same place an increase is seen for the concentration of W (curve b), i.e., here the electron probe intersects the phase having a higher content of W and a lower concentration of Fe.

The redistribution of elements in the region of the welded joint is explained as follows. During welding the steel-alloy butt joint is heated locally to sufficiently high temperatures, but since the heating time is limited, only the most easily-melted components in the fusion can cross over: Co and Fe (their melting points are, respectively, 1492 and 1539°C) [1]. The high-melting-point tungsten carbide (its melting point is 2600°C) remains in the solid state. The melting substantially facilitates and accelerates the mutual penetration of Fe and Co.

It follows from the constitution diagram of the Fe-Co alloy [2] that these metals are mutually soluble without limit even in the solid state. It can therefore be assumed that a solid solution of Co and Fe having a body-centered cyclic lattice is formed in the transition layer.

During welding the workpieces of VK-6 and steel are mechanically pressed against each other. The counter movement and mixing of the melted volumes of the steel and the alloy result in a relative shift of the unmelted tungsten-carbide particles and an equalization of