THE STRENGTHENING OF BORON FIBERS BY POLISHING OF TUNGSTEN WIRE SURFACE

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ABSTRACTS

Modern boron fibers (BF) with average diameter 95 mkm, as it is determined by fractography, mainly destructed because of boride core. On the contrary, BF 140-200 mkm diam. destructed due to two types of flaws: surface (60-30%) and core (40-20%). Fiber strengthening has been investigeted by flaw removal both from surface and core, and electropolishing is the most effective method. It has been shown that when initial tungsten wire being electropolished, the strength of BF 95 mkm diam. will rise from 3.5 GPa to 4.2 GPa. At combined treatment, consisting of electropolishing of tungsten before boron deposition, and also removal of boron layer 1.5-2.0mkm thickness from exterior surface, BF with diameter 136 mkm, av. tensile strength 4.8 GPa and variation coefficient less than 6% were obtained.

At investigation of process of BF strengthening by electropolishing some distinguishing features have been found. So in case of abscence of rough internal defects fiber strength has grown by 0.8-1.5 GPa and strength variation coefficient has decreased from 16-20% to 6-12%. However even in case of such small values of the latter, continuous sections of fiber are considerably distinguished (by 0.2-0.7 GPa) by average tensile strength in spite of similar type of destruction iniciators. The latter are localized in boride core area, and are not distinguishable neither by optical nor by electronic scanning microscope.

Samples of boron fiber with relatively low av. strength were exposed to boride-tungsten core etching from the fracture. In this case longitudinal marks on internal cylindri-
The surface of boron layer have been detected, which match the marks of tungsten boride core (Fig. 1).

![Image](image_url)

**Fig. 1.** Marks on internal surface of boron layer.

Marks are known to be formed on the surface of tungsten wire in the process of drawing. These marks are similar to those on both Soviet and Japanese, Swedish and American wire (Fig. 2).

![Images](image_url)

**Fig. 2.** Tungsten wire surface: a) typical, diam. 12.5 mkmm; b) semifinished item after drawing, diam. 14.2 mkmm; c) electropolished, diam. 12.5 mkmm.

The final stage of tungsten wire production is cleaning by annealing or electrochemical etching. Traces of lubrication and oxides are removed therewith in the second way wire diameter is worked up to required size, but surface texture is not changed. This parameter is not very important for electronics and electrical engineering. It also does not play a significant part in boron fiber production in case of raw defects presence. However as technology improving proceeds and with the advent of method of electrochemical removal of surface defects from BF, quality of tungsten substrate surface began to limit further growth of strength. Efforts to apply at electrochemical cleaning stage electrolytes, advisable for