

ENERGY SAVING

7.3. New sealing and fire-proof materials for power enterprises

7.3.2. Main characteristics of sealing materials of “Graphlex®” mark

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The basic material for producing the sealing products from TEG is the graphite foil, obtained from the natural graphite by means of some special technological operations, fulfilled in certain sequence.

The main stages of natural graphite processing from its cleaning to the production of graphite foil “Graphlex” with obtaining the sealing products are presented in fig. 7.12.

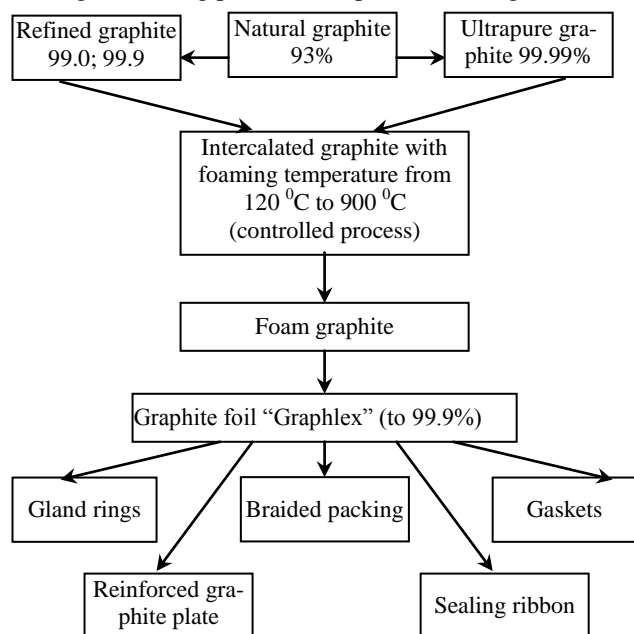


Fig. 7.12. General process flowsheet of natural graphite processing by technologies of SPA “Unikhimtek”

As it is seen from this flow sheet, the natural graphite is cleaned from impurities by two methods: the chemical cleaning for production of seals of general industrial assignment with the purity factor on carbon 99.0...99.5 % and thermal cleaning at temperature 2970°C (the ultrapure graphite with carbon content 99.9 %) for manufacturing the seals at NPP and especially important joints.

The oxidized (intercalated) graphite is obtained by means of special treatment of purified graphite. The foaming of graphite (as a result of which there is the multiple increasing of graphite scales volume and the name “thermally expanded” or “foam graphite” exists) is then carried out by means of thermal impact. By means of the sequent molding without binding agents, the foam graphite is transformed in the flexible graphite foil. The foil “Graphlex” is the initial material for manufacturing the wide range of gland rings and braided packing, sealing ribbon, flange gaskets, reinforced plate for manufacturing the sealing products.

The main characteristics of graphite foil “Graphlex” produced by SPA “Unikhimtek” are presented in table 7.3.

A quality of domestic graphite foil “Graphlex” corres-

ponds to the highest requirements of international and national standards of Germany and USA. The comparison of indicators of this foil pureness with the demands made for graphite foil of class GTA (class of “nuclear quality”) on American Standards ASTM is presented in table 7.4.

The high purity of foil «Graphlex», i.e. the minimal amount of harmful impurities in it (in particular, sulfur), is the guarantee of excluding the corrosion processes in sealing joints.

Table 7.3. Main characteristics of graphite foil «Graphlex»

Carbon content, %	99.0; 99.5; 99.8; 99.9*
Sulfur content, %	Less than 0.001
Chlorines content, ppm	Less than 20
Density, g/cm ³	0.5...1.3
Compressibility ($p = 35$ MPa), %	34... 60
Recoverability, %	8...19
Elastic recoil, %	7...10
E-module by DIN 28090, MPa	950
Tensile strength, MPa**	4...9
Thermal conductivity, W/(m·K):	
along the plate	130...200
across the plate	3
Electric conduction along the plate, Ohm ⁻¹ ·m ⁻¹ ·10 ⁵	0,70
Gas permeability by nitrogen, cm ³ · cm/(cm ² · s)**	Less than 2·10 ⁻⁶
Foil thickness, mm	0.1...1.5
Roll width, mm	1500
Roll length, m	to 100

* The values are presented for the different types of foil used for manufacturing the seals for the different types of equipment of general industrial assignment: the control accessories of high pressure, the equipment of the first NPP loop (class of “nuclear quality”).

** Is estimated with the pressure drop at membrane equal to 1 atm depending on density.

Table 7.4. Comparison of indicators of foil «Graphlex» purity with US standards

Indicator	Requirements of ASTM (USA)	Requirements of “Graphlex” (Russia)
Carbon content	99,8 % minimum	99,9 %
Fraction of total chlorine ions mass	20 ppm maximum	10 ppm
Fraction of total sulfur mass	450 ppm maximum	Less than 10 ppm