Approach to reliability test of power semiconductor elements.

Currently a score of types and modifications of power semiconductor devices at current up to 7000 A and operation voltage more than 6500 V are manufactured. However their reliability is guaranteed only by certain operation conditions. Real electrical and thermal modes of operation of power semiconductor devices can be various and naturally it influences their reliability.

"Proton-Electrotex, JSC" company considers the question of reliability from the view of reliability of semiconductor element functioning, correct planning of the device design and selection of appropriate materials.

Testing mode - electrothermocycling and appropriate equipment are used for analysis of correct selection of materials, which are applied in design of the device and the quality of mechanical contacts of anode and cathode surface of the element. Heating of the power semiconductor element is conducted by power current and cooling of the device is conducted by water. For analysis of reliability of semiconductor element the criteria of acceptability is used: blocking voltage and forward drop. A number of thermo cycles are used as an indicator of reliability. A number of thermo cycles can run up to hundred thousands and even millions. A number of thermo cycles for devices module design counts 10000 at temperature difference 100°C of semiconductor element, for devices of disk design - 20000 at temperature difference 100°C of semiconductor element.

Tests on gate mode are conducted for evaluation of design planning quality, correct selection of materials and production technology of semiconductor element. Gate mode is a testing mode at which DC voltage is applied to testing semiconductor element in non-conducting state. Temperature p-n junction is handled at level Tjmax and is estimated taking into account self-heating effect and under conditions of maintenance of thermal stability. In testing equipment high voltage is provided by high-resistant switching power supply of direct current. Blocking direct voltage which is 0,8 from grade of the device is applied to the testing device. Maintaining of high temperature on testing devices is conducted by digital measure-control of temperature independently for each testing device.

For analysis of reliability of semiconductor element the criteria of acceptability are taken: blocking voltage and loss current. Operation time is used as an indicator of reliability. Test duration is 1000 hours.

"Proton-Electrotex, JSC" conducts extensive work to increase the level of reliability of power semiconductor devices produced. Presented potential of "Proton-Electrotex, JSC" gives an opportunity to increase the quality of power semiconductor devices in the nearest future.