

The team of TB NORD has more than 30 years of experience in fabrication of thermoelectric modules (TEM). It was started in 1991 from company SCTB NORD (which named FerroTec Nord from 2012). The main achievements made for this time were: extruded TE material (year 1997) and «glued» module (China patent ZL 992064058 dated 05.04.1999). It is worth to say that without abovementioned technologies we could not see modules for TELECOM and LIDAR and modules for PCR-machines.

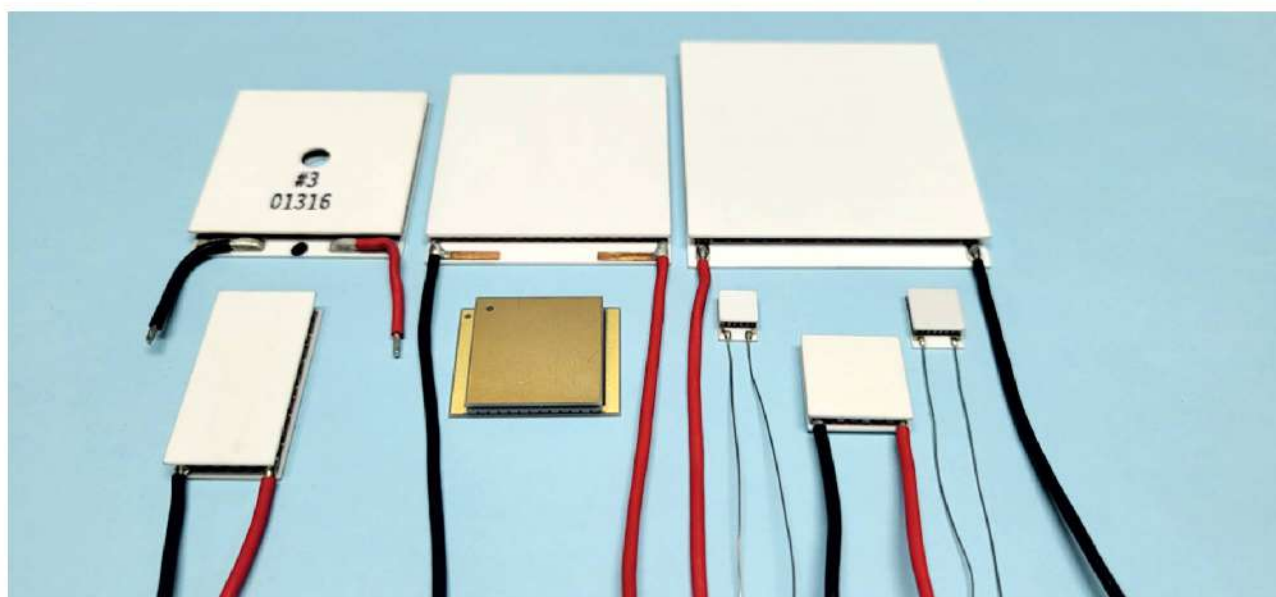
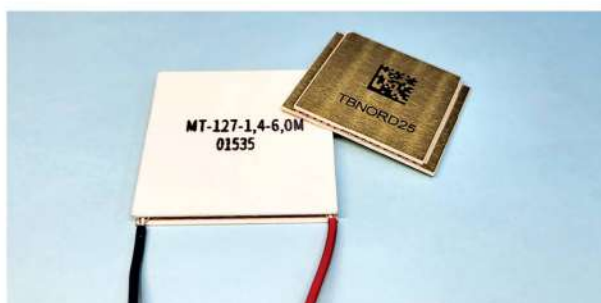
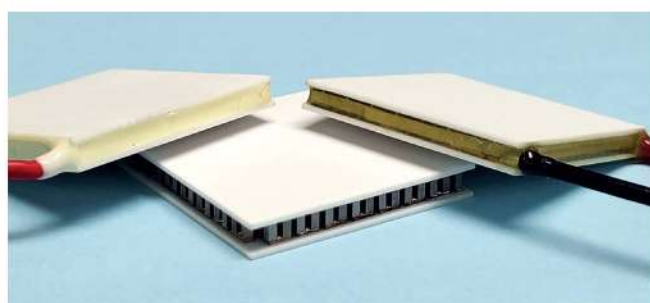
Last 30 years TB NORD technologists devoted for solution of problems with limited TEM applications and quality improvements.

- 1. The scale of TEM practical application** is restricted by production of tellurium which is subproduct at production of copper. These days there is only one way to solve this problem – reduction of dice height in TEMs, but it reduces lifetime due to arising mechanical stresses. Developed technology of fabrication TE materials by extrusion allows to produce modules with dice height as low as 0,2 mm. And introduction of elastic layers between copper pads and ceramic substrates (so-called «glued» module technology) has reduced mechanical stresses in TEMs essentially and it has given possibility to increase cycling reliability in many times.
- 2.** The critical issue connected with TEM reliability is a **quality of diffusion barriers** onto dices. The well-known application of Ni layers has disadvantage in non-controlled adhesion at thickness of Ni layer above 5 microns.  
We developed technology for application of special nickel alloy which does not exhibit so strong stressing properties after deposition by multilayers structure.
- 3.** The main «enemy» of TEMs working below dew point is **corrosion** of contacts between semiconductor dices and copper pads. Widely applied technology of protection modules via deposition of sealants around TEM perimeter can not provide reliable protection. Such modules demonstrate failures at level 1-2% already after 6 months of exploitation. We developed technology (patented in many countries) which gives possibility to cover all conductive parts in TEM by thin polymer layer which increases TEM lifetime in 5 times in comparison with traditional sealing and does not so reduce TEM efficiency.

4. Application of TEM for **generating purposes** requires special reliability of diffusion barriers to protect the penetration of solder components into semiconductor which arises temperature degradation of properties due to doping effects of TEM's working at temperature already above +100 C.

Our innovation with introduction of thick layers (about 100 microns) of aluminum in diffusion barriers (so-called H-technology) reduces degradation effects in many times. Besides it such technology increases cycling reliability of TEMs.

5. TB Nord LLC is certified by **ISO 9001:2015**



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