

УДК 62-97/-98

Iryna Demidenko¹, Olena Sivachuk²

¹ student of group E-419a sp NU “Zaporizhzhia Polytechnic”

² senior teacher NU “Zaporizhzhia Polytechnic”

FLEXIBLE THERMOELECTRIC GENERATOR

In everyday life, almost every day we encounter devices that heat up during operation, wasting their heat for nothing. For example, these can be engines, electric appliances or hot water pipes. Pennsylvania State University (PSU) scientists say they have created a new flexible thermoelectric generator (TEG) that can wrap around hot objects and convert their heat into electricity more efficiently than anything else.

Flexible thermoelectric (TE) generators are ideally suited for the most attractive sources of waste heat, such as pipes in industrial and residential buildings or exhaust systems of vehicles with internal combustion engines. And they don't need to be glued to surfaces like traditional rigid devices, which makes them less efficient.

Scientists successfully demonstrate large diameter wafers with uniform TE properties, high-power conformal half-Heusler (hH) TE modules for high-temperature application, and their direct integration on flue gas platforms, such as cylindrical tubes, to form large area flexible TEGs. This new conformal architecture design provides a breakthrough toward medium-/high-temperature TEGs over the conventional BiTe- and polymer-based flexible TEG design. A variable fill factor and greater flexibility due to the conformal design result in higher device performance as compared to conventional rigid TEG devices.

As a result of tests carried out on a hot duct, the new device demonstrated a 150% higher power density than other modern analogues. The larger version, at just over 7 square centimeters, retained a 115% power-to-weight ratio advantage. According to the scientists, they were able to achieve an output power of 56.6 watts when placed on a hot surface.

New thermoelectric generators consist of 72-couple hH legs exhibit a device high-power-density of 3.13 W cm^{-2} and a total output power of 56.6 W under a temperature difference of 570 °C.

These results provide a promising pathway toward widespread utilization of thermoelectric technology into the waste heat recovery application and will have a significant impact on the development of practical thermal to electrical converters. Such a system can store the effects of solar heating and radioactive cooling in one system without the need for electricity. This is an opportunity to preserve the ecosystem and help communities with limited access to electricity.