TECHNISCHE UNIVERSITÄT DRESDEN

ECEMP – European Centre for Emerging Materials and Processes Dresden

Development of braze-metal-systems for stable joints in thermoelectric generators

Sven Roszeitis

Thermoelectric generators (TEGs) transform thermal energy into electrical energy. The overall degree of efficiency η of a TEG is related to the thermoelectric degree of efficiency known as the thermoelectric figure of merit *ZT* and the Carnot Efficiency $\eta_C = (T_1 - T_0) / T_0$.

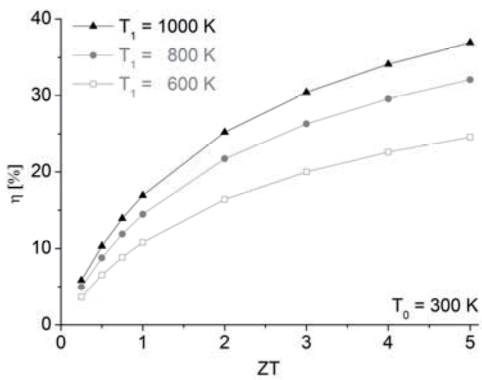

Fig. 1: overall degree of efficiency η over the thermoelectric figure of merit *ZT* at hot side temperatures T_1 of 600, 800 and 1000 K and constant cold side temperature T_0 = 300 K

As shown in Fig. 1, to increase the efficiency of a TEG the development of materials with high *ZT* and the increase of hot side working temperature are necessary. To increase the hot side working temperature stable joints realized by brazing are necessary.

The aim of this work is the development of braze-metals to join aluminium nitride (AlN), boron carbide (B_xC) and titanium suboxid (TiO_x) in a TEG-Modul (Fig. 2) for a working temperature up to 1000 °C. Commercial state of the art silver-based brazes limit the working temperature up to 450 °C. Two joining technologies are investigated: laser joining and brazing with pastes in a furnace.

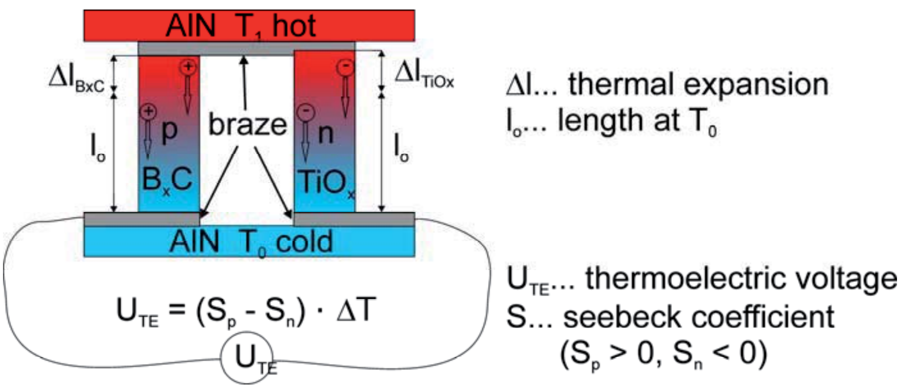

Fig. 2: section of a TEG-Modul

According to the thermoelectric demands the brazing metal needs a high electrical conductivity and a high thermal conductivity. The mechanical demands are suitable coefficient of thermal expansion, ductility, mechanical strength and durability against temperature cycling.