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BOOK OF ABSTRACT

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Characterization of the contact between Bi₂Te₃-based materials and lead-free solder alloy under thermal cycling

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The performance of thermoelectric (TE) modules can be significantly degraded under thermal cycling due to the inter-diffusion of solder alloy into the TE materials, as well as the formation of cracks [1]. In this work, contact between Bi₂Te₃-based leg and Tin-based solder alloy was fabricated both with and without the addition of Cr as a metallic buffer layer using a fast hot pressing method [2]. The evolution of the inter-diffusion layer during thermal cycling is investigated using interfacial microstructure analysis and the measurement of the change in the output power and the internal resistance of the leg. One side of the TE-leg is cycled between 25 °C and 200 °C with a ramping rate of 4K/min while the other side is held at ~5 °C. With a thin layer of Cr, the inter-diffusion layer of solder alloy was significantly suppressed (Fig. 1a) and more importantly the output power of the leg is maintained after 150 thermal cycles (Fig. 1b)

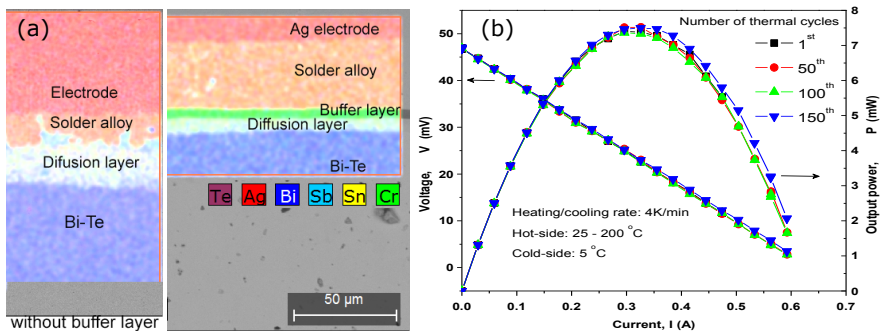


Figure 36: SEM micrographs of the interfaces between a typical Bi-Te leg and solder alloy with and without a thin Cr buffer layer (a) and power generating characteristics of such leg with various thermal cycling (b).

References:

- [1] E. Hatzikraniotis et al., "Efficiency Study of a Commercial Thermoelectric Power Generator (TEG) Under Thermal Cycling," J. Electron. Mater., vol. 39, pp. 2112 (2009).
- [2] P.H. Ngan et al., "On the challenges of reducing contact resistances in half-Heusler alloys-based thermoelectric generators", J. Electron. Mater., submitted (2015).