Thermoelectric module mechanical performance effects in Am-241 Radioisotope Thermoelectric Generators.

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Abstract. European Radioisotope Thermoelectric Generator (RTG) developments are targeted at the use of Am-241 based fuel. Recent laboratory ‘breadboard’ testing and analysis has demonstrated that bismuth telluride based thermoelectric materials offer a viable power conversion option. Thermoelectric modules based on commercially available units have been shown to offer a promising solution with clear benefits in lower development risk due to proven commercial manufacturing routes. A disadvantage of conventional bismuth telluride based thermoelectric materials is the poor mechanical integrity due to cleavage along the basal crystallographic plane. However, recent experimental studies have shown that (1) conventional modules can still withstand relatively high through-thickness compression loads, and (2) polycrystalline materials produced by spark plasma sintering and strengthened with dispersed phases offer improved material performance. The relationship between the compressive force clamping the thermoelectric modules to the heat source, and overall RTG performance has not been investigated for Am-241 RTGs. It is likely to be an important trade in the system due to the lower power density of Am-241 compared to Pu-238, and the need for high-aspect ratio thermoelectric legs. The results of a system-level modelling study on this effect, along with relevant mechanical experimental results will be reported.

Keywords: americium, RTG, bismuth telluride, system performance, mechanical properties