Abstract Submitted
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Skutterudite Thermoelectric Generator for Electrical Power Generation from Automotive Waste Heat[1] GREGORY MEISNER, GM Global Research and Development — Filled skutterudites are state-of-the- art thermoelectric (TE) materials for electrical power generation from waste heat. They have suitable intrinsic transport properties as measured by the thermoelectric figure of merit ZT = $S^2\sigma T/\kappa$ (S = Seebeck coefficient, σ = electrical conductivity, T = temperature, and κ = thermal conductivity) and good mechanical strength for operation at vehicle exhaust gas temperatures of >550 $^\circ$C. We have demonstrated TE electrical power generation on a production test vehicle equipped with a fully functional prototype TE generator (TEG). It was assembled with TE modules fabricated from filled skutterudites synthesized at GM. Our results and analysis show that improvement in total power generated can be achieved by enhanced thermal and electrical interfaces and contacts. A substantial T decrease along the exhaust gas flow results in a large variation of voltage, current, and power output for each TE module depending on its position in the module array. Total TEG output power depends directly on the position-dependent T profile via the temperature dependence of both ZT and Carnot efficiency. Total TEG power output also depends on how the modules are connected in parallel or series combinations because mismatch in output voltage and/or internal resistance among the modules degrades the performance of the entire array. Uniform T profiles and consistent TE module internal resistances improve overall TEG performance.

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