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Effects of Contact Resistances in Determining the Efficiency of Nanostructured Thermoelectric Coolers[1] AFSANA SHARMIN, ABU SADEQUE, VAMSI GADDIPATI, SHAIKH AHMED, Department of Electrical and Computer Engineering, Southern Illinois University, Carbondale, IL — Site-specific thermoelectric cooling in semiconductor materials is among the most promising approaches for the mitigation of on-chip hot spots resulting from the decreasing feature sizes and faster switching speeds of electronic components. The efficient usage of thermoelectric devices for hotspot cooling requires investigation of appropriate properties such as higher figure-of-merit, integration of these devices with electronic package, and remedy of various obstacles such as parasitic contact resistances. A multiscale simulation model has been developed to investigate the steady-state operation of nanowire based thermoelectric devices for hot-spot cooling considering the effects of thermal and electrical contact resistances. The results suggest that active hotspot cooling of as much as 20^{o}C with a high heat flux is achievable with Bi_2Te_3 nanowire based thermoelectric coolers. However, it has been observed that thermal and electrical contact resistances, which are large in nanostructures, play a critical role in determining the cooling range and lead to significant performance degradation of these novel reduced-dimensionality coolers.

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