Thermoelectric materials with embedded nanoparticles- An effective medium approach\textsuperscript{1} MONA ZEBARJADI, KEIVAN ESFARJANI, Department of ME, MIT, Cambridge, MA, ZHI XI BIAN, ALI SHAKOURI, Department of EE, U of California, Santa Cruz, CA, DARPA COLLABORATION — The effect of adding spherical nano-particles inside a host matrix is investigated using the coherent potential approximation. A parabolic band structure is assumed for the host matrix and it is shown that nano-particles can modify the effective mass by up to 20\% when their volume fraction is about 10\%. The effective band-structure can be fitted by the standard non-parabolic relation, resulting in the negative non-parabolic coefficients in the case of barrier type nano-particles. Interesting peaks have been observed in the group velocity curve versus energy when the nano-particles are deep wells and their volume fraction is more than few percent. We show that using a high volume fraction (~5\%) of relatively small (~1nm) uniform size nano-particles the power factor can be enhanced significantly especially at low temperatures.

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