# Improved figure of merit in nanograined Fe2VAl Heusler alloys

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**Résumé**

Bi2Te3 is currently the best thermoelectric (TE) material in the market, displaying a dimensionless figure of merit $ZT = 1$ at 300 K. The Heusler alloy Fe2VAl could be considered as a substitute of Bi2Te3, since it can either be doped as a $n$-type or a $p$-type conductor. Its maximum power factor ($PFmax$) can strongly be improved by substitution to values which can be larger than that of Bi2Te3 ($PF$max = 4.9 mW.m-1.K-2 at 300K) : $PF$max = 6.0 mW.m-1.K-2 at 300 K in $n$-type Fe2VTa0.05Al0.95 [1] for instance. However, its TE performances are mainly hindered by its large thermal conductivity $\lambda = 10$ W.m-1.K-1 in $n$-type Fe2VTa0.05Al0.95 at 300K – leading to $ZT$ _˜ 0.2 at 300 K. A reduction of thermal conductivity is thus necessary for the rise of Fe2VAl.
Nanostructuring by decreasing the grain size, increases the phonons scattering rate by the grain boundaries. This leads to a further decrease of the thermal conductivity. We here present results on ball-milled and spark-plasma sintered Fe2V1.03Al0.97 and Fe2V0.96Ta0.07Al0.97. From $\lambda L = 27$ W.m-1.K-1 at 300K in pristine Fe2VAl [3], this value is lowered in Fe2V1.03Al0.97 with sub-micrometric grain sizes to $\lambda L = 12$ W.m-1.K-1 and $ZT$ reaches 0.1 at 300K. The combination of grain size reduction and heavy Ta-substitution in Fe2V0.96Ta0.07Al0.97 leads to $\lambda L = 5$ W.m-1.K-1 and $ZT = 0.3$ at 300K, a value at the state of the art [3].

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