Derivation of equation used in designing single-stage semiconductor coolers

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Abstract: Maximum refrigeration capacity, maximum refrigeration temperature difference, and maximum refrigeration coefficient of semiconductor refrigerator are analyzed by mathematics, and the relationship between working current and parameter is discussed. Finally, some equations, such as $I=\frac{\alpha T_c}{R}$, $U=\alpha T_h$ in a condition of maximum refrigeration capacity, and $I_0=\frac{\alpha\Delta T}{R(M-1)}$, $U=\frac{\alpha\Delta TM}{M-1}$ in a condition of maximum refrigeration efficiency, are abtained. Calculation values from the equations are coincident with results from actual measurement, which shows that the derivation is reasonable, and the equations are reliable.

Key words: thermoelectric refrigerators; Peltier effect; refrigeration efficiency; formulas

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