Thermoelectricity: From Atoms to Systems

L4.2 Quiz

Answers

1) What is the optimal ratio between the load resistance and the internal resistance $m = R_{load}/R_{internal}$ that maximizes the power output of a thermoelectric system? (ZT is the average thermoelectric figure of merit of the system.)
   a. $m = 1$
   b. $m = ZT$
   c. $m = 1 + ZT$
   d. $m = \sqrt{1 + ZT}$
   e. None of the above

2) Thermal impedance of the TE power generation module should match the thermal impedance of the heat sink
   a. because this produces the largest temperature difference across the TE module
   b. because this produces the largest amount of power out from the TE module
   c. because this produces the largest heat flux through the TE module
   d. because this uses the least amount of thermoelectric material in the module
   e. None of the above, there is no requirement for thermal impedance matching.

3) Which of the following statements is true according to the component costs vs. heat flux plot of a thermoelectric power generation system shown in slide 7 of Lecture 4.2?
   a. Cost of the thermoelectric material decreases with increasing heat flux because the optimal thickness of the thermoelectric element for maximum power output is reduced.
   b. At high heat flux regime, costs of the heat sink and substrate become important in the total system cost.
   c. Micro-channel heat sinks can be a better option than air convection heat sinks when heat flux is high.
   d. Higher figure of merit material with lower thermal conductivity is more cost-effective than a material with the same figure-of-merit and cost but with higher Seebeck coefficient because the optimum thickness of the thermoelectric element is smaller.
   e. All of the above

4) What is the advantage of using fractional area coverage of thermoelectric elements in a thermoelectric module?
   a. Can reduce cost in sacrifice of power output
   b. Can reduce cost with almost the same power output
   c. Can increase power output significantly
   d. Can increase efficiency significantly
   e. Can reduce parasitic heat losses in the module