Pyroelectric Power Generation Technology

Pyroelectric power generation depends on temporal rather than spatial temperature gradients

Technical Details

- Potentially very light and compact inherently large heat transfer surface
- Scalable over a wide range of power and temperatures
- Efficiency is a function of cycle and materials
- No net emission, environmentally friendly materials
- Ceramic pyroelectric materials are mature and costs are understood

\[ \Delta Q = \frac{\partial P}{\partial T} \Delta T = p \Delta T \]
\[ i = \omega p T_o \cos(\omega t) \]
Pyroelectric Power Generation Cycles and Materials

Flow power
- 100 kW
- (650 to 422K)

Carnot power
- 60 kW

SECE cycle
- 40 kW
- \((k^2 = 1)\)

Induction of Temporal Fluctuation
- ? kW

Pyroelectric coefficient, as well as dynamic material properties such as specific heat and dielectric constant, are important.
Pyroelectric Power Generation Technology

Development Needs

• Develop technology to create pyroelectric material temperature fluctuations at high efficiency and low cost

• Material processing for:
  • Increased pyroelectric coefficient
  • Decreased dielectric constant and specific heat
  • Improved breakdown strength
  • Curie point tunability
  • Lower cost

• Identify and address issues of oxidation, corrosion, fatigue