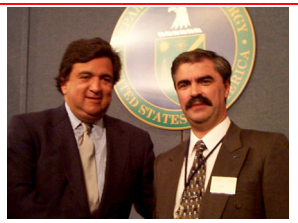
Demand-Driven Nuclear Energizer Module



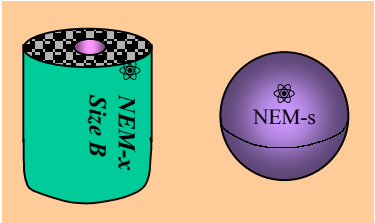
Bill Richardson & Pedro Otaduy

Dan O'Connor & Bill Magwood

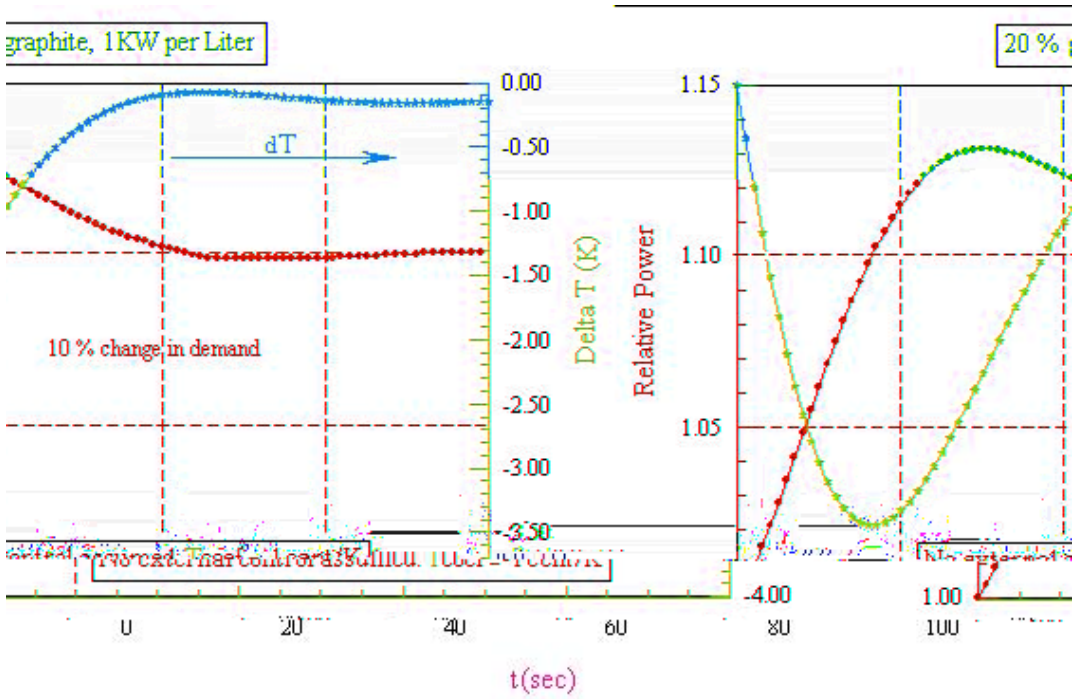
(4/19/99 at the NERI Awards Ceremonies)

- Develop a new generation of fission-based heat and radiation sources.
- To be accomplished by
  - pushing promising new technologies in the areas of ceramics, graphite foams and coatings, and composite materials;
  - adapting lessons learned from previous research in advanced reactor design.

-
-
-
-


NEM-s
NEM-x
Size B

-
-
-
-

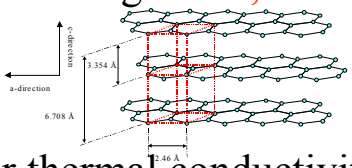

graphite, 1KW per Liter
20 %
dT
10 % change in demand
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
Delta T (K)
Relative Power
1.15
1.10
1.05
-4.00
1.00
0
20
40
60
80
100
t(sec)

ornl

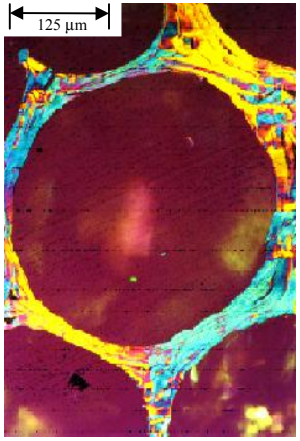
High Thermal Conductivity Carbon Foams

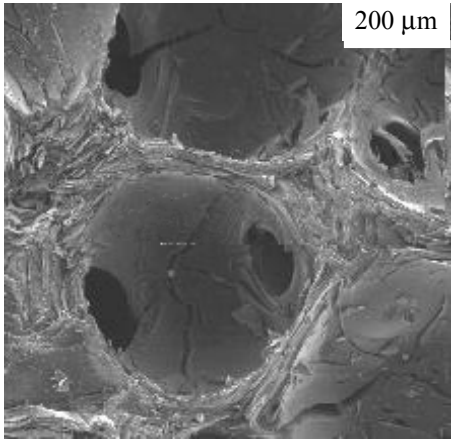
•Based on fabrication technique developed at Oak Ridge National Laboratory.
- Raw material is 100% mesophase pitch graphite

• The thermal conductivity of perfect single crystal graphite is as high as 2,000* W/m/K along the crystallographic basal planes (copper's is 400* W/m/K).



•ORNL's foam is of open microcell structure:
- The cell walls are made of oriented graphitic planes. Their thermal conductivity is estimated to be above 1500* W/m/K. The foam's overall thermal conductivity is greater than 180* W/m/K
- Specific conductivity is* 6 times greater than that of copper and 5 times that of aluminum.
- Large specific surface area (>4 m^2/g)
- Withstands temperatures as high as 3000°C.



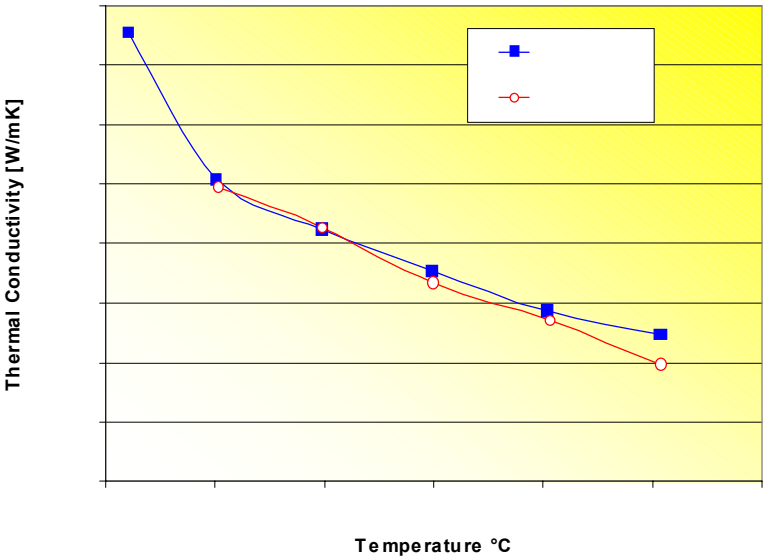


at room temperature (20 °C)

ornl

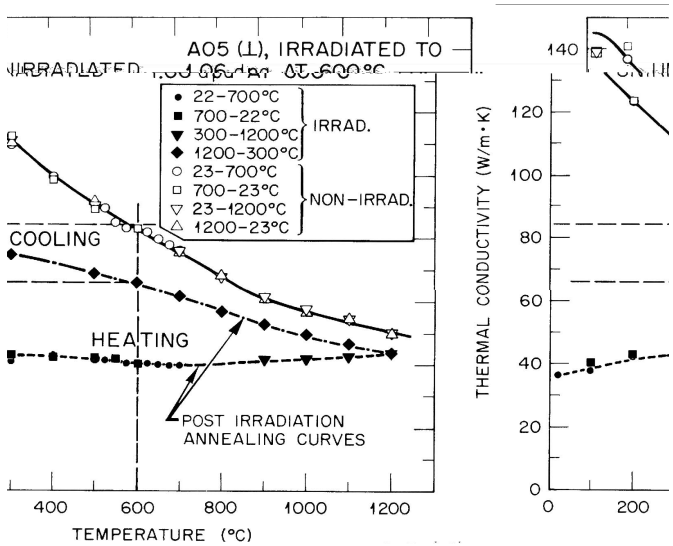
Thermal Conductivity of Materials Decreases with Temperature and Irradiation

Graphitized Carbon Foam 20 -> 500 °C



Graphite in the 20 -> 1200 °C

Unirradiated,
Irradiated 1 dpa at 600 °C, and
Annealed at 1200 °C



- Steam Generation
- MHD Electricity Generation
- Thermoelectric Generation
- Isotope Generation and Disposition
- H2 Generation
- Space Propulsion
- Space Habitat Heating
- Remote Communications and Beacon Stations

-
-
-
  -
  -
-
-
-