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Abstract Title: Flash Heating of a Hollow Rod to Determine Thermal Properties

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Introduction: The fuel for most commercial nuclear reactors is formed into small cylindrical fuel pellets. The fuel pellets are then stacked inside of hollow fuel rods, typically made of zirconium. These fuel pellets are packed into long cladding tubes which are typically 12 feet long, and 100 to 300 of these fuel rods are arranged into a fuel rod assembly for the reactor.

Objective: Estimate the thermal diffusivity of a silicon carbide (SiC) tube fabricated and tested at Oak Ridge National Laboratory. Due to the danger posed to personnel by highly radioactive components such as spent fuel, non-contact methods must be used to determine these properties. The flash method of diffusivity measurement may be a workable approach for this application if proper mathematical modeling can be applied to this geometry which has not been attempted before.

Methods: A flash-heating experiment was conducted on a SiC tube. This hollow tube is of similar geometry to the zirconium cladding of a typical fuel rod in a commercial reactor. A mathematical model is fitted to the temperature history recorded during the experiment.

Results: The thermal diffusivity was found to be 25.9 ± 0.471 mm^2/s with a standard deviation of the temperature residuals of 0.0918 K where the overall temperature rise in the experiment was approximately 3K.

Significance: Accurate knowledge of the thermal properties of the fuel rods is essential in predicting the peak fuel rod temperature during the operation of the reactor in order to avoid overheating damage to the fuel material. Properties of materials can change with exposure to high neutron flux, such as that ecountered during the life of the reactor.

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Reference: Beck, J. and Arnold, K., *Parameter Estimation*, Wiley, New York, 1977.