Letters to the Editor

Comment on the Existence of a Measured Discontinuity in the Thermal-Neutron Diffusion Coefficient Across the Ice-Water Phase Transition

In a Technical Paper Salaita and Robeson[1] state that their measurements in D_2O ice in conjunction with earlier measurements in H_2O ice and water support arguments for the probable existence of a discontinuity in the thermal-neutron diffusion coefficient across the phase transition for H_2O, independent of density effects. I would like to call the authors' attention to a recent Technical Note by Williams and Munno[2] where a review of much of the same data in water and ice together with an independent experimental and analytical study resulted in the conclusion that a discontinuity of the magnitude reported could not be substantiated. In this Technical Note it was pointed out that the reported discontinuity had been based largely on extrapolation of data in water at and above room temperature downward to the freezing point and that effects occurring local to the freezing point were not being considered. The Technical Note also presented new data below room temperature and a means for analytically estimating the size of the discontinuity from molecular weights of hydrogenous molecules. The analysis was based on simplified theory for scattering from bound hydrogen. When used with typical cluster models for water,[3] a discontinuity in terms of $R(D)$ an order of magnitude less than those presented by Salaita and Robeson can be predicted.[4]

A corollary purpose of this Letter is to suggest that improved accuracy in neutron diffusion measurements may make possible a new means for estimating the molecular weight of hydrogenous polymers. For example, if the accuracy of diffusion coefficient measurements could be increased by about a factor of 10 above present practice, it should conceivably be possible to observe a discontinuity at the ice-water phase transition and to define an effective size of a liquid water cluster near freezing.[4] Such an observation would be of clear scientific importance.

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[1]G. N. SALAITA and A. ROBESON, *Nucl. Sci. Eng.*, **46**, 214 (1971).

[2]P. M. WILLIAMS and F. J. MUNNO, *Nucl. Sci. Eng.*, **43**, 121 (1971).

[3]D. EISENBERG and W. KAUZMANN, *The Structure and Properties of Water*, Oxford University Press, New York (1969).

[4]P. M. WILLIAMS, "Pulsed Neutron Measurements in Water Near and Below Room Temperature," PhD Dissertation, University of Maryland (1971).

Comments on Application of Nonlinear Programming

In a recent publication, Malan and Koen[1] describe the application of the SUMT method of nonlinear programming to the optimal control of point model nuclear reactors. By failing to reference previous directly related publications, the authors create a false impression that their paper is the first to apply nonlinear programming techniques (and SUMT in particular) in the solution of optimal control problems of nuclear reactors.

In fact, the SUMT method was applied to optimal control problems in the nuclear reactors field four years ago and the results published in the literature.[2,3] A thorough literature search should be an integral part of any research work.

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[1]G. F. MALAN and B. V. KOEN, *Nucl. Sci. Eng.*, **46**, 385 (1971).

[2]D. TABAK, "A Direct and Nonlinear Programming Approach to Optimal Nuclear Reactor Shutdown Control," *IEEE Trans. Nucl. Sci.*, **NS-15**, 57 (1968).

[3]D. TABAK and B. C. KUO, *Optimal Control by Mathematical Programming*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1971).

Reply to "Comments on Application of Nonlinear Programming"

The optimization problem of Malan and Koen[1,2] and the optimization problem of Tabak[3] complement one another toward the ultimate goal of complete optimal control for nuclear reactor systems, but they are clearly two different optimization problems. Recent publications by Malan and Koen[1,2] were the first to report the application of nonlinear programming to the optimal control of nuclear reactors, describing the reactor model by the reactor kinetics equations, one prompt group, and six delayed groups of neutrons with power feedback, and having reactivity as the control variable. Tabak[3,4] was the first to report the

[1]G. F. MALAN and B. V. KOEN, *Trans. Am. Nucl. Soc.*, **13**, 621 (1970).

[2]G. F. MALAN and B. V. KOEN, *Nucl. Sci. Eng.*, **46**, 385 (1971).

[3]D. TABAK, "A Direct and Nonlinear Programming Approach to Optimal Nuclear Reactor Shutdown Control," *IEEE Trans. Nucl. Sci.*, **NS-15**, 57 (1968).

[4]D. TABAK, "Application of Mathematical Programming in the Design of Optimal Control Systems," PhD Dissertation, University of Illinois (1968).