



10/27/76 *Perk*
CPB *Reading*

MEMORANDUM FOR: P. S. Check, Chief, Core Performance Branch, DSS
THRU: R. O. Meyer, Section Leader, Reactor Fuels Section
FROM: M. Tokar, Reactor Fuels Section, CPB
SUBJECT: MEETING SUMMARY; IRRADIATION BEHAVIOR OF $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$

On October 8, 1976 a meeting was held with Samuel C. Weaver, President of U. S. Nuclear, Inc., on the irradiation behavior of $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$. U. S. Nuclear is a fabricator of $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ burnable poison pellets for B&W. Dr. Weaver's presentation to the staff was essentially a summary of (1) U. S. Nuclear experience with $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ pellets and (2) a literature survey of observations of the irradiation and corrosion behavior of Al_2O_3 and B_4C . A list of attendees is herewith attached. Copies of the meeting slides are available in the PDR and branch files.

Dr. Weaver subdivided his talk into the following seven segments:

1. Characteristics of U. S. Nuclear $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ Pellets
2. U. S. Nuclear Fabrication Experience
3. $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ Irradiation Behavior
4. Al_2O_3 Irradiation Behavior
5. B_4C Corrosion Behavior
6. Al_2O_3 Corrosion Behavior
7. $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ Compatability With Zircaloy Tubing

The following major points were made by Dr. Weaver:

1) U. S. Nuclear cold presses and sinters its $\text{B}_4\text{C} - \text{Al}_2\text{O}_3$ pellets. The dimensional control obtained via this fabrication process is so good that no centerless grinding is required. Therefore, a major potential source of water adsorption is avoided.

2) A review of KAPL and BNL data on $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ indicated that desirable characteristics for good irradiation performance of $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ include (a) intermediate densities (65 - 85% T.D.), (b) small grain size Al_2O_3 , and (c) low moisture content.

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3) Expected irradiation behavior of $\text{Al}_2\text{O}_3 - \text{B}_4\text{C}$ includes (a) a diameter increase of -1% at 100% burnup of ^{10}B , and (b) 1 - 2% gas release at 100% burnup of ^{10}B .

4) A rate equation for B_4C water corrosion (obtained on B_4C powder) was provided as:

$$\text{Rate} = 0.14 P_{\text{H}_2\text{O}} A e^{-11,000/RT} \text{ (g/m}^2\text{-h-mmH}_2\text{O)}$$

Assuming 1600 psi H_2O pressure, 0.44m /g surface area, and 575°F, the reaction rate determined by this equation is 0.34%/h.

5) Al_2O_3 degrades in H_2O at PWR temperatures (exact mechanism uncertain).

In summary, Dr. Weaver made a convincing case that $\text{B}_4\text{C} - \text{Al}_2\text{O}_3$ burnable poison pellets, when properly fabricated and incorporating the above cited characteristics, will perform satisfactorily.

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LIST OF ATTENDEES

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