TRIP REPORT

ASTRONUCLEAR LABORATORY

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WANL-TR- 6649

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Trip to: Abar Corporation

Date of Trip: June 10, 1971

*File
Reynolds material*

PURPOSE OF TRIP

To review Abar Corporation's first attempt at H₂ leaching ZrC material.

PERSONS PRESENT

WANL

E. Duran, Manufacturing
W. Brizes, Materials

Abar

H. R. Martindell, Mgr., Heat Treating Dept.
W. Jones, Vice President

MASTER

SUMMARY

- i. Their first attempt was unsuccessful. However, their furnace and personnel appear to be capable of satisfying our requirements for H₂ leaching ZrC. A number of problems were encountered in their first run as outlined below, but these are not considered major and should be solved by a redesign of their furnace retort. *(Needs WANL guidance)*

Problem Areas

1. An apparent tantalum metal coating was deposited on the 100 test pieces of ZrC during the H₂ leaching cycle.
2. The samples bonded to the tantalum metal fixtures.
3. Approximately 5% linear shrinkage and warpage occurred.
4. All the specimens appeared to have been uniformly affected.

It should be noted that none of these problems occurred when WANL H₂ leached this same material.

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Test Conditions

Samples were heated to 1400°F in argon (3 minute ramp) and then to 2200°C in H₂ (25 minute ramp). The samples were held at 2200°C for 7 hours in a 1 cfm hydrogen flow and then cooled to room temperature in argon. The rectangular retort was made of 0.025 in. Ta sheet, and the specimens were placed on 0.040 in. Ta shelves inside the retort. The H₂ gas was introduced and expelled via Ta tubes which penetrated the top and bottom of the retort, respectively. A vacuum pump was used to remove the H₂ and to insure a negative pressure in the furnace. A tungsten heating element with tungsten radiation shields resulted in a very clean furnace.

Recommendations

1. Abar check the internal temperature of the retort. Depending upon the efficiency of the tungsten radiation shields, the specimen may have been at a higher temperature than measured on the exterior surface of the retort.
2. The tantalum tubes carrying the H₂ to the retort were badly crimped resulting in loss of H₂ through overlapped joints into the furnace and a reduced H₂ flow into the retort. These tubes should be redesigned.
3. Holes were found in the retort and were probably formed by electrical arcing from the retort to the tungsten wire mesh heating element. These holes were found in a region of the retort that would allow H₂ to escape before passing over the ZrC specimens.
4. The tantalum metal shelves should be replaced by tungsten screen to reduce compatibility problems and to increase the H₂ leaching efficiency.
5. The H₂ gas should be passed through a number of layers of tungsten screen to preheat the H₂ and to reduce temperature gradients that may have been partially responsible for the deposition of Ta on the ZrC samples.
6. WANL will experimentally determine if the vapor pressure of Ta is too high at the leaching temperature. If found to be a problem, the retort may have to be made from tungsten foil.
7. WANL will send an additional 100 samples to Abar for H₂ leaching after the above mentioned modifications are made.
8. It is recommended that WANL personnel physically review Abar's leaching apparatus before their next run.