

From: XU Hongqing <Hongqing.XU@framatome-anp.com>
To: "William Cullen" <WHC@nrc.gov>
Date: Friday, November 01, 2002 3:23PM
Subject: RE: Clad thickness

Bill,

See my take on your questions below your original text. Let me know if you have additional questions.

Would you be able to confirm for me that I understand some details about the clad thickness for the two thinnest measurements shown in the results: the 0.208" measurement near the 270° position, and the 0.202" reading near the 90° position?

Xu: Correct.

As I interpret the numbers, there is a depression (corrosion-related??) on the exposed clad side. There also appears to be a change in elevation on the normally wetted side, but it is nearly zero in magnitude.

Xu: From visual (including stereomicroscope), there is no evidence of localized depression on the top side. There is an elevation (bulging) in the center on the top side due to RCS pressure. The two corners in question are more difficult with microscope, but there is not evidence of local depression due to corrosion (wastage).

Looking at the spreadsheet "Top Side", which is the exposed side, I believe, (Xu: correct) at (4.08, -2.93) the dial gage (dg) reading is -0.141, a decrease of about 70 mils with respect to neighboring measurements. At (-1.37, -2.67) the dg reading is -0.142, a decrease of about 50 mils wrt neighboring measurements. There is however, a steady gradient from right to left of about -40 mils per inch, so to be fair, I need to reduce (the magnitude of) these "decreases" by about 20 mils, bringing them to 50 and 30 mils resp.

Xu: The RV head is curved and its placement on the measuring bench may be tilted. In addition, the exposed cladding beads are not smooth. Hence localized elevation variation on one side surface is difficult to interpret.

Looking at the "Clad Side", all the signs in these calculations (except the gradient) are reversed, but it appears that (.349 - .322) is .027, less about 20 mils is ~0.007, and (0.344 - ~0.325) is 0.019, less 0.020 is about nothing. So the bottom line is that the absolute elevation of the wetted surface changed hardly at all, but the exposed side, subjected to corrosion, seems to have lost material.

Am I looking at this correctly?? Or is everything reversed, and the depression is on the wetted side, and might be due to grinding around the nozzle weld?

Xu: You have the correct top and bottom sides.

If I am looking at that correctly, and there is some apparent "lost" material in these two corners, do we have an item in the sectioning and exam

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plan to take a look at the surface morphology to attempt to determine whether or not the solutions in the cavity corroded the clad? I have some data from an old Climax Molybdenum handbook that suggests that 304 stainless steels do corrode at an appreciable rate at about 300°F in concentrated boric acid solutions. The apparent lack of corrosion of the exposed clad suggests that this did not happen. My measurements of thickness (from BWXT photographs via your reports) suggest that the thickness of cladding still attached to the base and the thickness of the exposed cladding are pretty much the same, suggesting no loss of thickness, except in those two areas. Can you shed some light on what might be the situation, and whether you think it warrants a closer look?

Xu:

1. It could be due to cladding bead thickness variation (these two corners seem to be on the same bead).
2. The proposed sectioning plan (emailed to FENOC yesterday) focused on the cracks, but I am open to move one (SEM/Optical met mount) sample to one of the two corners.
3. First, 308L cladding is slightly richer in Cr than 304. Second, the top surface of the exposed cladding appears to be the fusion interface diluted by the low alloy steel, indicating this diluted interface had not been entirely corroded away. However, I agree we need to look at one of these two corners to confirm if it was due to bead thickness variation, or boric acid corrosion of the cladding did happen in the corners.
4. In my email (detailed sectioning plan draft, based on 9-24-02 meeting in Lynchburg) sent yesterday to FENOC, I would like to have a conference call between 11/04/ - 11/12/02 before finalize the sectioning plan.

-----Original Message-----

From: William Cullen [mailto:WHC@nrc.gov]
Sent: Friday, November 01, 2002 12:32 PM
To: HXu@framatech.com
Cc: SFyfitch@framatech.com; jwhyres@mcdermott.com; Allen Hiser; Carol Moyer; James Davis; Michael Switzer
Subject: Clad thickness

Good afternoon, Hongqing,

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If I am looking at that correctly, and there is some apparent "lost" material in these two corners, do we have an item in the sectioning and exam plan to take a look at the surface morphology to attempt to determine whether or not the solutions in the cavity corroded the clad? I have some data from an old Climax Molybdenum handbook that suggests that 304 stainless steels do corrode at an appreciable rate at about 300°F in concentrated boric acid solutions. The apparent lack of corrosion of the exposed clad suggests that this did not happen. My measurements of thickness (from BWXT photographs via your reports) suggest that the thickness of cladding still attached to the base and the thickness of the exposed cladding are pretty much the same, suggesting no loss of thickness, except in those two areas. Can you shed some light on what might be the situation, and whether you think it warrants a closer look?

Thanks,

Bill

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