

SNO-STR-93-029**CRAZING OF STRESSED ACRYLIC INDUCED
BY RADIACWASH AND BORIC ACID**

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ABSTRACT

Radiacwash and a 5% boric acid solution were tested to determine compatibility with acrylic plastic under a tensile stress of 2000 psi magnitude. The results of these experiments provide an indication as to whether either of the compounds can safely be used on the acrylic D₂O vessel at the Sudbury Neutrino Observatory (SNO). It was found that neither Radiacwash nor boric acid caused crazing or other damage to the acrylic.

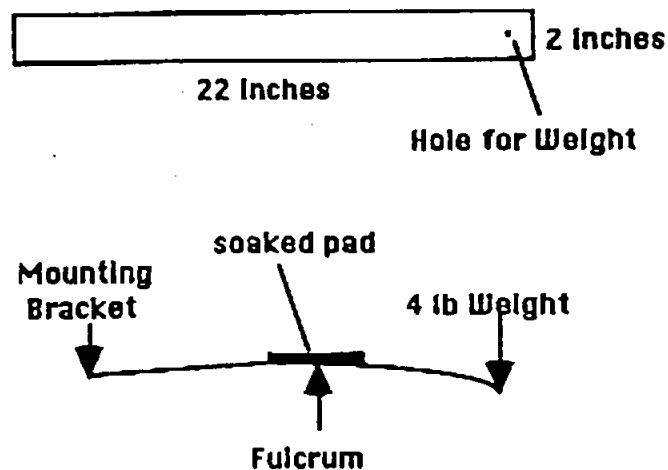
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INTRODUCTION AND TEST OBJECTIVES

The Sudbury Neutrino Observatory (SNO) will employ high purity heavy water (D_2O) as the primary medium with which neutrinos will interact. ¹ The heavy water is contained by a large, spherical ² acrylic vessel. These tests were conducted to determine if Radiacwash and boric acid are suitable for use on the SNO Acrylic D_2O Vessel. The criteria for suitability are primarily that the compounds being tested do not induce crazing or in any other way compromise the integrity of stressed acrylic.

APPARATUS AND PROCEDURE ³

The side edges of twelve 2" x 22" x 0.25" pieces of Plexiglas were polished by wet sanding with 600 grit sandpaper, and a 0.125" hole was drilled about 0.75" from one end of each piece of Plexiglas. The Plexiglas pieces were mounted in a bracket and put under a 2000 psi magnitude tensile stress by three point dead weight loading. One end of the piece was held fixed by the bracket with the fulcrum located 10.5" from the fixed end. A 4 LB weight was suspended by a string from the other end via the 0.125" hole. The 4 LB weight consisted of a two liter soft drink bottle filled with about 1.74 L of water. Resting on top of the piece of Plexiglas directly above the fulcrum was an absorbent pad consisting of a pair of folded Kimwipes. The pad was kept soaked for the duration of the test.



The pieces of Plexiglas were inspected with polarized light and a polarizing filter before each test to insure that the specimens were stress free. At the conclusion of each test, the specimens were again inspected in the same manner to compare the amount of relative stress remaining in the piece after being removed from the bracket.

The boric acid solution was prepared by dissolving 100 grams of boric acid powder of the type used as a disinfectant into water to yield 2 liters of solution, giving a 5% by mass solution with a molarity of 0.81.

The Radiacwash was not diluted from its concentrated form.

The duration of the test was eight hours, with routine inspections for crazing. At the initiation of each test, the specimens were inspected often--on the order of every 15 to 20 minutes--with the interval increasing to every hour as the test progressed.

RESULTS AND OBSERVATIONS

In the control group, no crazing was observed. The only residual stress in the Plexiglas after the pieces were removed from the bracket occurred along the point where the fulcrum rested, and was quite small. This residual stress could only be seen when the piece was viewed edge on.

Neither Radiacwash nor Boric Acid was observed to induce any crazing, and residual stress was no different from that of the control group.

CONCLUSIONS

Both Radiacwash and Boric Acid are likely to be safe for use on the SNO vessel. Neither compound caused any crazing or appeared otherwise to adversely affect the integrity of the acrylic.

REFERENCES

- ¹ Sudbury Neutrino Observatory Proposal, SNO-87-12, October 1987.
- ² Design Report for the Acrylic Vessel, DK-17-351-01, 11/8/92. Copies available from SNO Institute, Queens University.
- ³ Stachiw, J. D. "Stress Corrosion Crazing of Acrylic Plastic Induced by Cleaning Solutions". Stachiw Associates, December 1991.