

**SNO-STR-94-012**

**CRAZING OF STRESSED ACRYLIC INDUCED  
BY MAGNESIUM CHLORIDE SOLUTIONS**

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**ABSTRACT**

Solutions of Magnesium Chloride of various concentrations 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 Magnesium Chloride can safely be used on the acrylic D<sub>2</sub>O vessel at the Sudbury Neutrino Observatory (SNO). It was found that Magnesium Chloride did not cause crazing or other damage to the acrylic.

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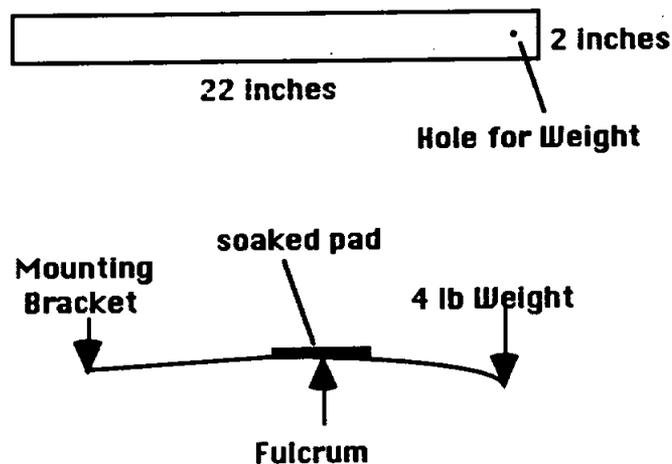
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## INTRODUCTION AND TEST OBJECTIVES

The Sudbury Neutrino Observatory (SNO) will employ high purity heavy water ( $D_2O$ ) as the primary medium with which neutrinos will interact. <sup>1</sup> The heavy water is contained by a large, spherical <sup>2</sup> acrylic vessel. These tests were conducted to determine if Magnesium Chloride is suitable for use in the SNO Acrylic  $D_2O$  Vessel. The criteria for suitability are primarily that the Magnesium Chloride solution does not induce crazing or in any other way compromise the integrity of stressed acrylic.

## APPARATUS AND PROCEDURE <sup>3</sup>

The side edges of five 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 with the Magnesium Chloride solution for the duration of the test.



The Magnesium Chloride solutions were prepared by dissolving a corresponding amount of MgCl<sub>2</sub> Anhydrate in 500 mL of distilled water. The amounts of MgCl<sub>2</sub> Anhydrate are listed below.

Percent by mass of solution	Amount of MgCl <sub>2</sub> Anhydrate
0.25 %	1.25 grams
0.5 %	2.5 grams
1.0 %	5.0 grams
2.0 %	10.0 grams

A control test using distilled water only was also run as a comparison.

The duration of the test was twelve 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**

No crazing was observed nor any other indications that Magnesium Chloride has any affect on acrylic, adverse or otherwise. There appeared to be no discernible difference between the Magnesium Chloride test group and the control test.

## **CONCLUSIONS**

Magnesium Chloride is likely to be safe for use in the SNO vessel. It was not found to cause any crazing and did not appear to otherwise adversely affect the integrity of the acrylic.

## **REFERENCES**

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