

It's my intention that this idea should be a part of the public domain and should never be patented.

This idea was first posted on the internet, and was first declared to be public domain, on Sunday, December 14, 2008. I originally documented the idea on Friday, May 6, 1977.

Page 1 of this document was first completed on Sunday, December 14, 2008 and was most recently revised on Thursday, April 15, 2021. Pages 2 through 6 are as originally completed on the dates shown on those documents.

I didn't do a word count for this document.

This collection of information presents

- my notification of the GE Division Patent Counsel, dated July 26, 1977, of my recommendation that GE investigate the desirability of using glass fuel channels, and consider getting a patent on the idea, and
- my documentation of the design idea.

On July 26, 1977, I presented this idea to the GE Division Patent Counsel. Some time later, I presented the idea to the GE patent review committee. To the best of my memory, I did so by letter, although my files don't contain a copy of that letter. The members of the committee decided that the idea wasn't worthy of any further development and that GE didn't want to pursue it. Somebody notified me of the decision by telephone. So far as I can recall, the committee declined to put its decision in writing. So, I don't have any documentation of any response at all, by GE, to my suggestion. Anyway, I have declared my glass fuel channel idea to be in the public domain. I intend that it can be used by anybody and that it cannot ever be patented.

At the time, I believed that the idea was rejected because everybody involved, except me, had inhibiting preconceived notions about the characteristics of glass. I figured that they just thought about windows and baseballs. Strangely, many years later, in May of 2019, I ran across the information that's shown below, and which was written 20 years earlier, that tended to corroborate my suspicion. I found it in Chapter 6 of *The Hidden Persuaders*, by Vance Packard. Here's the quote.

Sometimes our fears of products seem completely irrational until they are probed by an expert. The Corning Glass Works came up against a seemingly illogical resistance to the Pyrex glass pipe it was trying to sell to engineers and purchasing agents for chemical food processing. Technically they had a very good sales story, but the customers showed strong resistance to the idea of using such pipe no matter how good it was supposed to be. So the company called in Dr. Charles Winick, research consultant. He sent a team of psychologists out to talk to would-be purchasers. Here was their conclusion, in the words of the *Wall Street Journal*: "The engineers and purchasing agents have an 'emotional block' about the glass pipe's fragility based upon experiences in their childhood involving glass. They learned as little boys that a broken water glass always led to a spanking." The company began coaching its salesmen how to spot and take into account such irrational resistance in their sales talks.

—*The Hidden Persuaders*, Vance Packard
Pocket Books, Inc., New York, Copyright, © 1957 by Vance Packard

Over the years, I've noticed many new and innovative uses of glass. I still believe that glass fuel channels would have been a good idea.

BWR SYSTEMS DEPARTMENT
San Jose, California

July 26, 1977

TO: Division Patent Counsel
FROM: Sam A. Milam III
SUBJECT: DISCLOSURE OF POTENTIALLY PATENTABLE IDEA

The invention herein discussed, consists of a proposed change in the material used to manufacture BWR fuel channels. It is proposed that these channels, which are currently fabricated from ZIRCALOY 4, should be made instead from properly formulated glass.

BWR fuel channels constitute the outer boundary of the fuel assembly in Boiling Water Reactors and as such are subject to mechanical and thermal stress, irradiation influences, and the corrosive action of the operating BWR environment. This places upon the channel a sufficiently high level of duty that permanent deformation and corrosion occur. Such deformation and corrosion eventually limit the capability of the channel such that it must be replaced. It is desirable to limit deformation and corrosion in order to achieve a significant increase in channel lifetime.

A preliminary literature search has indicated that glass has potentially attractive properties when compared to ZIRCALOY. A brief comparison of properties is attached. The glass used in the comparison is a silicate glass, Corning Glass 7940. When examining this comparison, it should be kept in mind that this glass was NOT designed for use in a nuclear reactor environment, but was instead, a standard manufactured product. Considerably more attractive properties might be expected from a glass formulated specifically for the nuclear environment. Note also that Corning Glass 7940

Sam A. Milam III
Inventor

26 July 1977
Date

Read and Understood by:

H.W. Samai

JULY 26, 1977
Date

Gerald A. Percis

7/26/77
Date

was a standard product over ten years ago. Glass technology has advanced during the past ten years, so that the comparison shown in the attachment is actually between outdated glass and modern ZIRCALLOY. Even so, the comparison is impressive.

It is felt that the properties shown in the comparison are sufficiently encouraging to warrant a more extensive investigation of the available and potential properties of modern glass, and the capabilities of glass manufacturers to fabricate such glass into parts with the size and tolerance requirements of BWR fuel channels. It is also felt that, in the interests of future sales potential, the idea should be protected by a legal patent.

Sam A. Milan III
Inventor

26 July 1977
Date

Read and Understood by:

HW Jamai

JULY 26, 1977
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SCOTT A. PERCIE

7/26/77
Date

Attachment

REFERENCE: Kirk-Othmer Encyclopedia of Chemical Technology, Second Edition, Volume 10, Executive Editor - Anthony Standen, Interscience Publishers, a Division of John Wiley & Sons, Inc., 1966.

	<u>7940 Glass</u> 99.9% SiO ₂ <u>.1% H₂O</u>	<u>Zircaloy-2</u>
Upper Temperature Use Limit (°C)	900 - 1300	1420°C
Thermal Stress Resistance (Temperature Difference Across Wall to Cause 1000 PSI Stress on Cold Surface)	290°C	60°C
Poisson's Ratio	.16	142
Young's Modulus	10.5 X 10 ⁶ PSI	12.3 X 10 ⁶
Density	2.2 g/cm ³	6.6 g/cm ³
Hardness	5-7 (Mohs) 500-600 (Knoop)	175 (Brinell) 170-280 (Knoop)
Thickness Loss in Boiling Water	2 X 10 ⁻⁸ in/hr	2 X 10 ⁻⁷ in/hr
Thermal Exp Coef	5.5 X 10 ⁻⁷ /°C - 7 X 10 ⁻⁷ /°C	1.6 X 10 ⁻⁶ /°C
Tensile Strength		18,000-52,000 PSI
Tempered Glass	15,000-35,000 PSI	
Normal Design Strength (Values as high as 200,000 exist)	1500-6000	
Neutron Absorption Cross Section (Barns)	σ _a = .16 σ _s = 1.7 σ _t = 1.86	σ _a = .185 σ _s = 8 σ _t = 8.2

Sam A. Milam III
Inventor

26 July 1977
Date

Read and Understood by:
HW Jamai

July 26, 1977
Date

Donald A. Lewis

7/26/77
Date

DOCUMENTATION OF DESIGN IDEA

1. Proposal

My proposal is that BWR fuel channels should be made of a properly formulated glass or glass ceramic material.

2. Reasons

A preliminary literature search indicates that glass could potentially have highly attractive properties, i.e., corrosion resistance, temperature capability, elastic modulus, creep resistance, low neutron absorption cross sections, etc. Results of the literature search are attached.

3. History

I originally conceived the idea on April 29, 1977. On May 2, 1977, I conducted a brief literature search to determine whether or not the idea was sufficiently promising to warrant further consideration. On May 3, 1977, I presented the idea informally to my Manager, H. W. Tamai, and on May 4, 1977, I presented it to H. A. Levin, who stated that he would give the idea some thought. Throughout this period of time, I discussed the idea at some length with G. A. Pierce and K. E. Watkins.

SIGNED	<u>Sam A. Milam III</u>	DATE	<u>6 May 1977</u>
WITNESSED	<u>K E Watkins</u>	DATE	<u>5/6/77</u>
WITNESSED	<u>James A. ...</u>	DATE	<u>5/6/77</u>

REFERENCE: Kirk-Othmer Encyclopedia of Chemical Technology, Second Edition, Volume 10, Executive Editor - Anthony Standen, Interscience Publishers, a Division of John Wiley & Sons, Inc., 1966.

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