

17 1738

Charge: 1270
Problem: 247

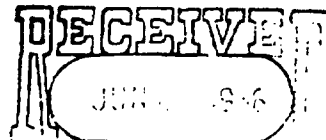
PLAINTIFF'S EXHIBIT

DOW-1028

COPIED IN MIDLAND CRI
FEB 10 1951

RADIATION-INDUCED DAMAGE TO GASKET

MATERIALS



07500

by

CENTRAL RESEARCH INDEX

R. C. Huber INDEXED:
B. W. Wilkinson

S.W. 5

NR-58016-1U

May 5, 1958

510283909

THIS REPORT IS THE PROPERTY OF THE DOW CHEMICAL COMPANY

RADIATION-INDUCED DAMAGE TO GASKET MATERIAL

SUMMARY

Materials of 5 compositions were irradiated to find a suitable material for a Co^{60} reaction vessel. Materials tested were: Rubber, cork, Teflon, fiber and asbestos. These were irradiated for doses of 0, 10, 100, 500 and 1000 megaRads.

The asbestos materials stand up the best. Rubber cork, Teflon and Vellumoid tend to get brittle.

INTRODUCTION:

In reactions using Co^{60} radiation, the gaskets on the reaction vessels often failed sooner than normally expected. This report covers 14 gasket materials that are in stock at Dow. Irradiation was done at the Radiation facility of the Nuclear and Basic Research Laboratory using a Co^{60} radiation source. These materials were irradiated for doses of 0, 10, 100, 500 and 1000 megaRads, and tested for Shore Durometer A Hardness and durometer elasticity.

EXPERIMENTAL PROCEDURE:

Samples of Saran rubber, Silastic 51, sponge rubber, Neoprene rubber, Red (rainbow) rubber, Red rubber, JM 60, JM 61, JM 83, Durabla, Garlock 7021, Vellumoid, Teflon and cork were obtained from the Dow gasket stockroom. See Table I for composition and supplier.

Three inch gaskets were cut out of these materials and divided into 5 sets. These sets were irradiated for 0, 10, 100, 500 and 1000 Megarads at room temperature. The radiation intensity was 535,000 rads/hr. (measured by ferrous dosimetry).

After irradiation the gaskets were tested for hardness and elasticity using a Durometer A Hardness tester and a durometer elasticity tester in the Saran Development Laboratory.

ST0283910

EXPERIMENTAL RESULTS:

Table II gives the hardness and elasticity of the gasket materials tested.

After 10 Megarads of radiation the Teflon gaskets became brittle and broke. After 100 Megarads the Vellumoid began to turn a lighter color. After 500 Megarads the Silastic, sponge rubber and vellumoid became brittle and broke. After 1000 Megarads the cork began to crumble. See Figures 1 and 2 for conditions of the gaskets at various dosages of radiation.

DISCUSSION OF RESULTS:

The scission of the carbon-fluorine bond is believed to cause the degradation of Teflon, as Teflon is a poly tetrafluoro ethylene polymer.

The rubber gasket materials probably degrade because of the side chains splitting off. Most of the natural and synthetic rubbers have side chains or double bonds which tend to break under radiation. These in turn can polymerize, crosslink or release HCl, forming a different molecular structure.

The cork and Vellumoid gasket materials are cellulose base. Cellulose degrades under radiation.

The asbestos fiber, used in asbestos gasket materials is a mineral fiber. Minerals are inorganic and inorganic materials are usually more stable than organic materials under radiation. It is expected that if asbestos gaskets fail under radiation, the damage would be in the binder.

CONCLUSIONS:

Asbestos gasket materials are more radiation resistant than rubber, cork, Teflon and Vellumoid.

Rubber gasket materials tend to harden as the amount of radiation increases, while Vellumoid, cork and Teflon get brittle.

ST0283911

NOTEBOOK REFERENCE:

Nuclear Research Notebook Number 86, Page 19.

INDEX HEADINGS:

Radiation damage of Gaskets

Gamma Radiation: *effect on gaskets*Gaskets, Damage ~~to~~ Radiation

R. C. Huber / Brow
Author

B. W. Wilkinson
Author

Alden W. Hanson
Approved by

May 27 - 58
Date

Rubber: radiation effect on
" " "

Cork:
" " "

asbestos:
" " "

Ethylene: tetrafluoro-, polymers, " " "

ST0283912

ST0283913

TABLE I

<u>GASKET MATERIAL</u>	<u>MANUFACTURER</u>	<u>COMPOSITION</u>
Saran Rubber	Dow Chemical Co.	
Silastic 51	Dow Corning	
Sponge Rubber		Natural Rubber
Neoprene Rubber	DuPont	
Red Rubber (rainbow)	Boston Woven Hose Co.	Filled
Red Rubber	Goodyear	Filled
JM 60	Johns Manville	Asbestos sheet, Graphited on one side
JM 61	Johns Manville	Asbestos and G.R.S. Binder, no graphite
JM 83	Johns Manville	Asbestos and acid resistant binder
Durabla	Durabla Mfg. Co.	Asbestos sheet 4
Garlock 7021	Garlock Packing Co.	Asbestos sheet with rubber binder
Vellumoid	Vellumoid Co.	Fiber base
Teflon	DuPont	Unfilled tetrafluoro ethylene polymer
Cork		Natural

ST0283914

TABLE II

GASKET MATERIAL	Dose MegaRads	HARDNESS					ELASTICITY				
		0	10	100	500	1000	0	10	100	500	1000
Saran Rubber		72	75	85	100	100	52	49	26	Too Hard	
Silastic 51		56	60	83	95	*	33	27	13	7	*
Sponge Rubber		22	22	22	89	95	46	48	34	3	0
Neoprene Rubber		74	78	85	100	100	Too thin for Penetrator				
Red Rubber (rainbow)		85	86	90	96	98	22	18	16	12	**
Red Rubber		83	85	93	100	100	Too thin for Penetrator				
JM 60		95	96	98	93	95	**	**	**	**	**
JM 61		97	97	95	94	98	**	**	**	**	**
JM 83		83	84	81	79	84	13	7	10	10	9
Durabla		94	98	97	90	96	**	**	**	**	**
Garlock 7021		94	95	93	87	88	**	**	**	**	**
Vellumoid		93	93	90	88	*	Too thin for Penetrator				
Teflon		100	100	*	*	*	Too thin for Penetrator				
Cork		64	68	70	67	67	2	4	4	3	0

* Too Brittle

** Too Hard

Irradiated Gasket Materials

• ASBESTOS • CORK • VELLUMOID • TEFLON •

MEGA RADS.	JM 60	JM 61	JM 83	Durabla	Garlock 7021	Vellumoid	Teflon	Cork
0								
10								
100								
500								
1000								

ST0283915

Irradiatedasketaterials

MEGA RADS	R U B B E R				
	Saron	Silastic 51	Sponge	Neoprene	Red Style 50 Red
0					
10					
100					
500					
1000					

ST0283916