EFFECTS OF THERMAL AGING ON THE MECHANICAL PROPERTIES OF RX-03-BB

H. D. Johnson

DEVELOPMENT DIVISION

JANUARY - MARCH 1976
SANL No. 458-002

For
Lawrence Livermore Laboratory
Livermore, California

Mason & Hanger - Silas Mason Co., Inc.
Pantex Plant
P. O. BOX 647
AMARILLO, TEXAS 79177
806-335-1581

operated for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
under
U. S. GOVERNMENT Contract DA-11-173-AMC-487(A)

DISCLAIMER

EFFECTS OF THERMAL AGING ON THE MECHANICAL PROPERTIES OF RX-03-BB

H. D. Johnson

DEVELOPMENT DIVISION

January - March 1976

SANL No. 458-002

ABSTRACT

A study was conducted to determine the effects of thermal aging on the mechanical properties of RX-03-BB Blend 7. The heat-treated and control specimens strain-at-failure in tension were 0.28% and 0.36%, respectively. The heat-treated specimens produced an average diameter growth of 1.25 mm/m.

DISCUSSION

Seven tensile specimens were fabricated from RX-03-BB Blend 7 Pressing No. 83343Y3101. The tensile specimens average finished density was 1.903 Mg/m^3. Four of the tensile specimens were placed in an environmental chamber and heat treated at a constant temperature of 60 C for 30 days. These parts were gaged for density and dimensional measurements and had a dye penetrant check performed to assure there were no cracks. There was an average diameter growth of 0.025 mm and an average density loss of approximately 0.003 Mg/m^3. The 25.4 mm diallyphthalate end caps were bonded to the seven tensile specimens with Epon 828 and Epi-Cure 87 epoxy resin and the specimens were desiccated for a minimum of 16 hours prior to testing.

The control specimens (Piece Nos. 5, 6 and 7) and heat-treated specimens (Piece Nos. 2, 3 and 4) were tested at 21 C at a constant crosshead speed of 0.002 mm/s. The average strain-at-rupture of the heat-treated parts was 0.28 ± 0.02% as compared to the control specimens average rupture strain of 0.36 ± 0.04% (see Tables I and II). The heat-treated specimens average rupture stress was 9.55 MPa versus 9.80 MPa for the control specimens. Data presented in Fig. 1 show the average stress-strain curve of the heat-treated parts superimposed on the control test results. The tensile specimens rupture surfaces on both groups appeared to be identical.

CONCLUSION

No significant differences were observed between the heat-treated specimens and the control specimens stress-at-rupture. However, the heat-treated specimens strain-at-rupture was less than the control specimens. This difference may have been caused by (1) crystallinity which occurred in Kel-F binder as a result of thermal aging, or (2) growth effects, or a combination of the two. The degree of crystallinity in the specimens is currently being measured and additional studies are planned which will more clearly define the effect of Kel-F crystallinity on physical properties.

Table I. Tensile Test at 0.002 mm/s at 21 C for RX-03-BB, B7

(Lot No. 5218-145-01, Pressing No. 83343Y3101, Density 1.903 Mg/m^3)

CONTROLS

Piece No.	Rupture Mode [a]	Time (s)	Rupture Stress (MPa)	Rupture Strain (%)
5	6	687	9.70	0.39
6	2	320	9.79	0.38
7	4	358	9.90	0.32
Mean		455	9.80	0.36
Std. Dev.		202	0.10	0.04

[a] *1 & 7 are in curved section, 2 & 6 are in the straight section outside the extensometer; 3 & 5 are at the knife edge and 4 is between the knife edges*

Table II. Tensile Test at 0.002 mm/s at 21 C for RX-03-BB, B7

(Lot No. 5218-145-01, Pressing No. 83343Y3101, Density 1.903 Mg/m^3)

HEAT TREATED

Piece No.	Rupture Mode [a]	Time (s)	Rupture Stress (MPa)	Rupture Strain (%)
2	4	312	9.20	0.27
3	6	383	10.00	0.28
4	2	410	9.45	0.30
Mean		368	9.55	0.28
Std. Dev.		51	0.41	0.02

[a] *1 & 7 are in curved section, 2 & 6 are in the straight section outside the extensometer; 3 & 5 are at the knife edge and 4 is between the knife edges*

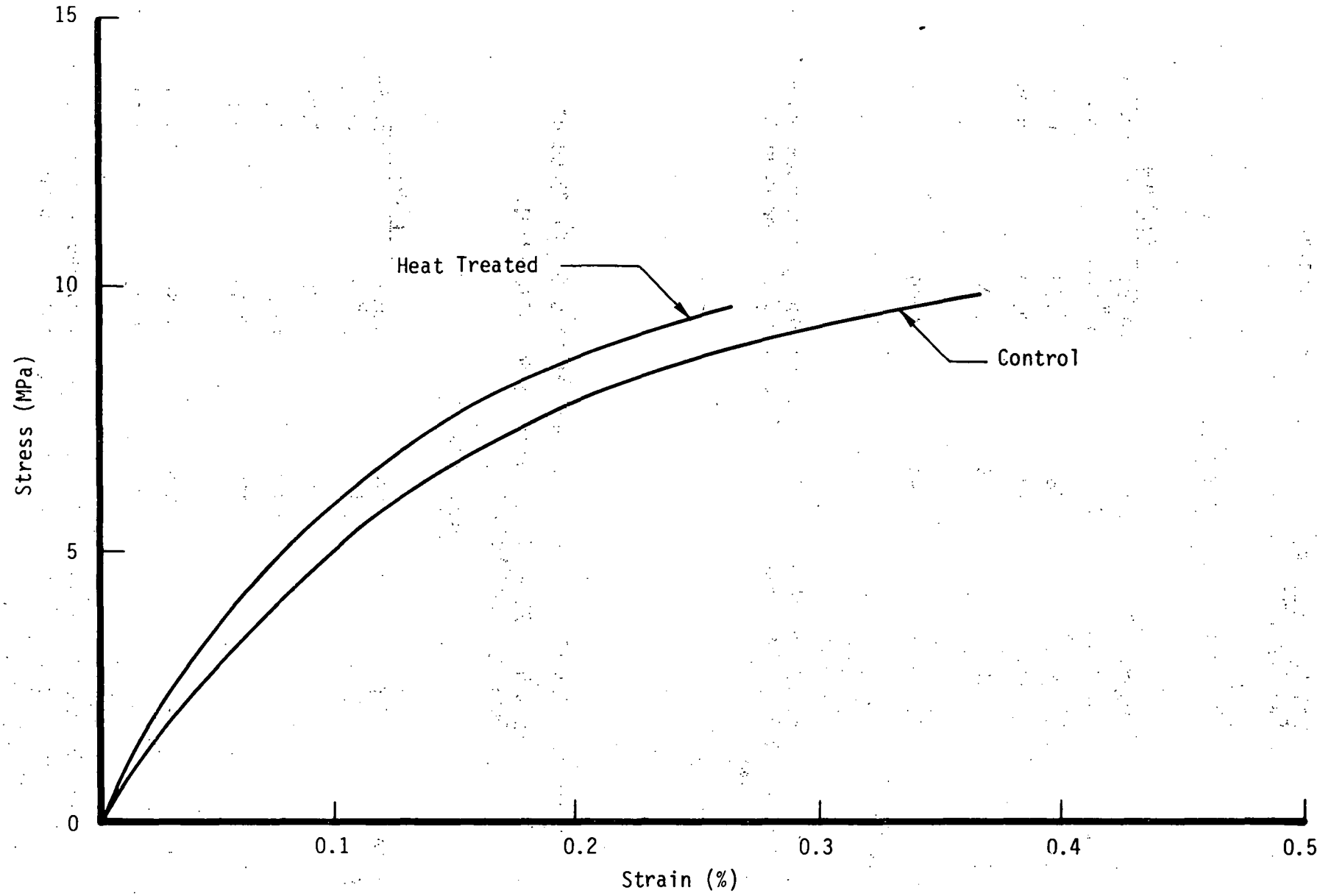

Fig. 1. RX-03-BB Tensile Tests at Constant Crosshead Velocity of 0.002 mm/sec at 21 C