Rigid Foam IPN 20-649 Type 1

TECHNICAL DATA

General

This material was primarily developed for insulation of liquid H_2 fuel tanks for launch vehicles.

The material, which is referred to as an Inter-Polymer-Network, consists of a polymeric alloy of a highly cross-linked polyamide-urea and a ductile linear vinyl polymer. The cryogenic properties are good and the material exhibits excellent short-term capability at high temperatures. IPN 20-649 is thermo-formable.

Physical Properties

Density range		40 - 50 kg/m^3
Thermal conductivity	at 100 K	0.015 w/m K
	at 210 K	0.027 w/m K
	at 310 K	0.033 w/m K
Linear contraction Coefficient	90-310 K	4 x 10^{-5} / K
Tensile strength	at 20 K	0.9 Mpa
Ult. tensile strain	at 20 K	1.5 %
Poisson's ratio		0.3

Compressive Properties Through the Plane (@296K)

Compressive strength	0.5 – 0.7 Mpa
Compressive modulus	50 Mpa (B)
	20 Mpa (A)

Tensile Properties in the Plane (@296K)

Tensile strength	0.7 – 1.0 Mpa
Tensile modulus	20 – 30 Mpa
Ultimate tensile strain	5 %

Shear Properties all Directions (@296K)

Shear strength	0.4 – 0.6 Mpa
Shear modulus	12 – 17 Mpa
Ultimate shear strain	10 %

Dimensions (approx.)

Length	7 ft
Width	3 ft
Thickness	Max 1 ½"

B. ASTM D1621 Proc. B
A. ASTM D1621 Proc. A

SP-R-0022A (ASTM E 595 77)

TOTAL MASS LOSS AND COLLECTED CONDENSABLE MATERIALS FROM OUTGASSING IN A VACUUM ENVIRONMENT (VCM TEST)

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Actual test report on file and available upon request.

Rigid Foam IPN 20-649 Type 2

Test Sample Description

Average Sample Thickness	0.315 cm (0.124 in.)

Additional Information

The test material was cut into ¼" squares for placement into the sample containers.

Preparation Information

Low material density precluded testing of standard 250-milligram samples.

Test Conditions

Final Test Pressure	4×10^{-4} Pa (3×10^{-6} torr)
Test Sample Temperature	398 K (125 °C)
Test Collector Plate Temperature	298 K (25 °C)
Test Duration	24 hr.

TEST RESULTS, OBSERVATIONS, AND COMMENTS

TABLE 1. TEST RESULTS

Calculated Results	Sample 1	Sample 2	Sample 3	Average Values
Post-conditioning Weight (g)	0.029	0.027	-	-
Weight Loss (%)	3.35	3.46	-	3.41
Volatile Condensable Material (%)	0.00	0.00	-	0.00
Water Vapor Recovery (%)	0.71	0.66	-	0.69

NOTE: The maximum estimated random deviation observed in the percentage of volatile condensable material with a sample mass of 0.250 gram is 0.02 percent. The random deviation is inversely proportional to the sample mass. The random deviation of the percent volatile condensable material with the less than standard sample mass used in this test is estimated to be 0.19 percent.