



Advanced Circuit Materials

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*Properties*  
2.9.1

## Low Outgassing Characteristics of Rogers Laminates Approved for Spacecraft Applications

RT/duroid® composites of PTFE with inorganic fiber filler and TMM® temperature stable hydrocarbon composites, have outstanding resistance to outgassing, according to data compiled by NASA test procedure SP-R-0022A. Reinforced PTFE laminates and PTFE composites are thermally stable and have universal outgassing characteristics. Similarly, TMM temperature stable laminates are highly crosslinked hydrocarbons which do not evolve gases or by-products at elevated temperatures. Test data shown in the table (back page) were obtained on specimens etched free of copper foil.

The test procedure<sup>2</sup> consists of vacuum heating 100 to 300 mg specimens in a copper enclosure, with exit port at 125°C for 24 hours with a chrome-plated collector maintained at 25°C located 12.7 mm from the exit port. The Total Mass Loss (TML), Collected Volatile Condensable Materials (CVCM) and Water Vapor Recovered (WVR) are expressed as a % of the original specimen mass. In general, materials with TML over 1.0 or CVCM over 0.10 should be avoided in spacecraft applications.

### References:

1. William A. Campbell, Jr. and Richard S. Marriott of Goddard Space Flight Center, Greenbelt, MD, "OUTGASSING DATA FOR SPACECRAFT MATERIALS", NASA Reference Publication 1124, August 1987.

*Note: The database of RP1124 is updated weekly and may be accessed or downloaded from the NASA website at <http://epims.gsfc.nasa.gov/og/>.*

2. ANSI/ASTM E595-84 "Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment", American Society for Testing and Materials, Annual Book of Standards.

Material Type	RT/duroid® 5870 Laminates	RT/duroid 5880 Laminates	RT/duroid 6010 Laminates	RT/duroid 6002 Laminates	TMM® 3 Temperature Stable Laminates	TMM10 Temperature Stable Laminates	3001 Bonding Film	RO4003C™ High Frequency Circuit Materials	ULTRALAM® 2000 Laminates
Composition	PTFE Glass-microfiber	PTFE Glass-microfiber	PTFE Glass-microfiber Ceramic filler	PTFE Glass-microfiber Ceramic filler	Thermoset Polymer Composite	Thermoset Polymer Composite	Thermoplastic Chlorofluoro-copolymer	Hydrocarbon Cermic Woven Glass	PTFE Woven
Nominal Dielectric Constant	2.33	2.20	10.2	2.94	3.27	9.20	2.28	3.38	2.40-2.60
<b>ASTM 595-84</b>									
%TML	0.05	0.03	0.03	0.02	0.04	0.06	0.13	0.06	0.03
%CVCM	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.02
%WVR	0.04	0.02	0.02	0.01	0.03	0.04	0.02	0.02	0.02

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