

## Welcome!

This page provides access into the Window Materials Database (WinMD). This database was developed by NASA to provide performance information for windowpane material selections. The performance information was developed by conducting a variety of tests representing spacecraft relevant environments and performance conditions. The NASA Spacecraft window team welcomes you to browse this information to perform your trade studies for new spacecraft window designs. ***Per fenestram ad astra!***

For more information on the development philosophy of the WinMD, please read [this](#).

To submit recommendations (of new materials to test or specific other tests), comments, or suggestions, please email [here](#).



- **The purpose of the Window Material Database (WMD) is to characterize window materials for the spaceflight environment in a standardized way to facilitate spacecraft window design trades**
  - Only material properties/functionalities will be evaluated (not a specific pane design or window design characteristics)
  - Data will be stored in a NASA partner accessible online database (similar to MAPTIS)
    - In the interim (while data is being developed), data will be made available to designers upon request
  - Standardized processes, procedures, facilities, personnel and material thicknesses will be used for characterization
    - Same material sizes (.5" thick)
    - Same testing methods
    - Same testing laboratories
    - Same testing personnel
    - Same measurement instrumentation
    - Test environments are standardized and applied to all materials

# Introduction to the NASA Window Materials Database (WMD)

## Continued



- **This philosophy allows an apples-to-apples comparison between performance parameters for different materials**
  - Data is collected by objective NASA personnel
  - No concerns for mismatched testing methodologies between materials
  - No concerns for supplier creative marketing departments, embellishments or gimmicks
- **Spacecraft/habitat design companies do not have to perform development testing to determine how a material candidate will function in the defined spaceflight design environments**
- **Characterization Parameters will be established synergistically with classical NASA window design requirements and will be relatable to them**
  - Structural requirements from JSC 65828 (ductile materials)
  - Structural requirements from NASA STD-5018 (brittle materials)
  - Optical requirements from JSC 66320

# What does this mean for NASA Partners/Window Designers?



- **Enables partner designers to pursue innovative and integrated window subsystem designs instead of by trial and error to find an appropriate material (or just going with the same heavy designs of the past)**
  - Will enable challenging future mission scenarios such as long duration habitats or rovers
  - Engineers can assess the risk associated with meeting their mission and performance requirements
- **Enables partner designers to optimally match mission requirements to window materials**
  - Will enable lightweight window subsystems
- **The WMD is intended to be released for use to the spaceflight industry (there has also been cited interest in ground applications as well)**
  - Online/web-based access (users must have an NDC password & 2 factor authentication)

# Materials and Tests included in the WinMD baseline development



- **Materials**

- Makrolon AR
- Lexan MR10
- Lexan 9034
- Zelux W
- Spartech Poly II
- Spartech SAR
- Plexiglas
- GKN 350C (cast)
- GKN 350S (stretched)
- Fused Quartz (Tosoh N Material)
- ALON (Surmet)
- Fused Silica

- **Data formats**

- Test Plans
- Test Reports
- Raw Data (plots, photos, videos, spreadsheets, pdfs)
- Quick Reference Summary Data

- **Tests included**

- Baseline Optical Characterization-plastics
- Environmental exposures
  - Atomic oxygen
  - Radiation
  - VUV/NUV
  - Hypervelocity Impact (HVI)
- Post exposure Optical characterization
- Pre-exposure baseline strength
- Post exposure strength testing
  - HVI impact
  - Atomic Oxygen Exposure
  - UV/Radiation exposure
- Thermo-optical properties (emissivity, absorptivity, degradation temperature)
- Creep testing (Plastics)
- Flammability
- **Thermal Vacuum Testing (incomplete)**

# Characterization Parameters and Current NASA Partner Centers and Responsibilities



- Spaceflight relevant environments will be applied to characterize material performance

\*\* Temperature dependent creep planning is in work at JSC (May 2021)

Mechanical	Thermal	Optical	Environmental
Slow Crack Growth	Thermal Emissivity	Transmittance & Reflectance	Atomic Oxygen Stability
Fracture Toughness	Solar Absorptivity	Color Balance	Flammability
Ultimate/Yield strength	Thermal Degradation Temperature (Plastics)	Haze	Thermal Vacuum Stability
Modulus of Elasticity		Optical Wedge	Temperature dependent Creep**
Creep		Striae	Ionizing Radiation Tolerance
Impact tolerance (low and hypervelocity) / Residual Strength		Birefringence	UV Stability
		Wavefront Quality	
		Imagery Quality	

GRC Task
  JSC Task
  JSC/WSTF Task
  LaRC Task
  MSFC Task

# User Access and Organization



- **All data is releasable for use as a design tool for future space venturing vessel window designs**
- **Data is accessed by NASA partners via an online WinMD Website**
  - Users must obtain a NASA ndc domain account to acquire access
  - Permission to access the WinMD must be requested via NASA NAMS