

# Testing and Comparison of Ionic Liquid Fibers and NARC Fibers

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# NARC Fiber

## What is NARC fiber?

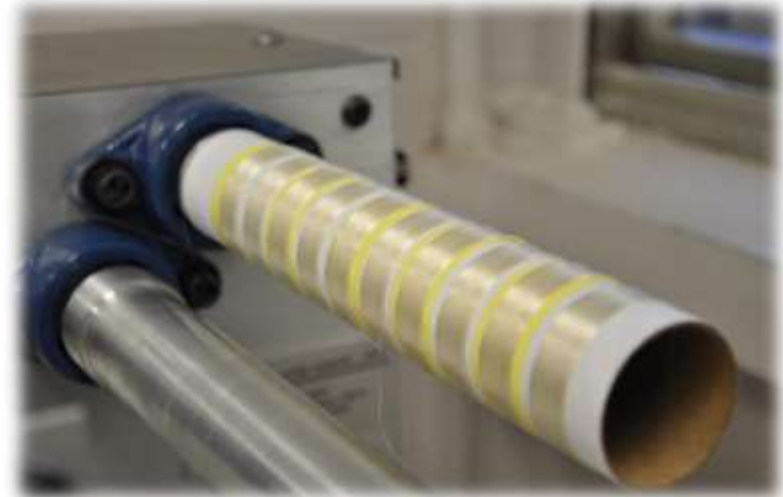
- NARC stands for North American Rayon Corporation
- Viscose rayon fiber: cellulose based
- NARC rayon is the fiber precursor for some specialty high temperature carbon fiber applications



# Ionic Liquid Fiber

## What is Ionic Liquid Fiber?

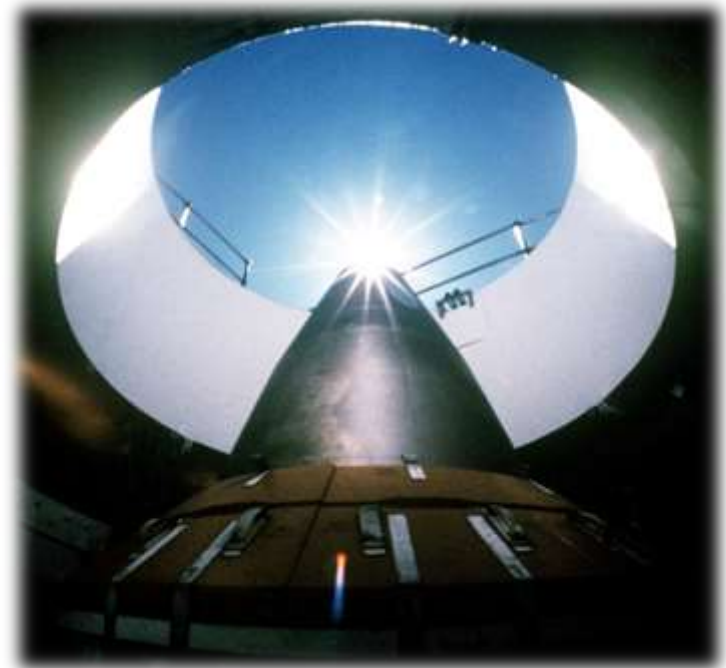
- Cellulose based fiber currently in development.
- Is used as a precursor for carbon fiber currently in development



# Future Cellulose-based Carbon Fiber

## Why replace NARC?

- **Manufacturing potentially damages the environment**
- **Cost prohibited by EPA**
- **Stockpile decreasing**
- **Most carbon fiber not suitable for specialty high temperature applications**
- **Need a US supply of cellulose-based carbon fiber**



# Tests used to compare fibers

Several different tests have been performed:

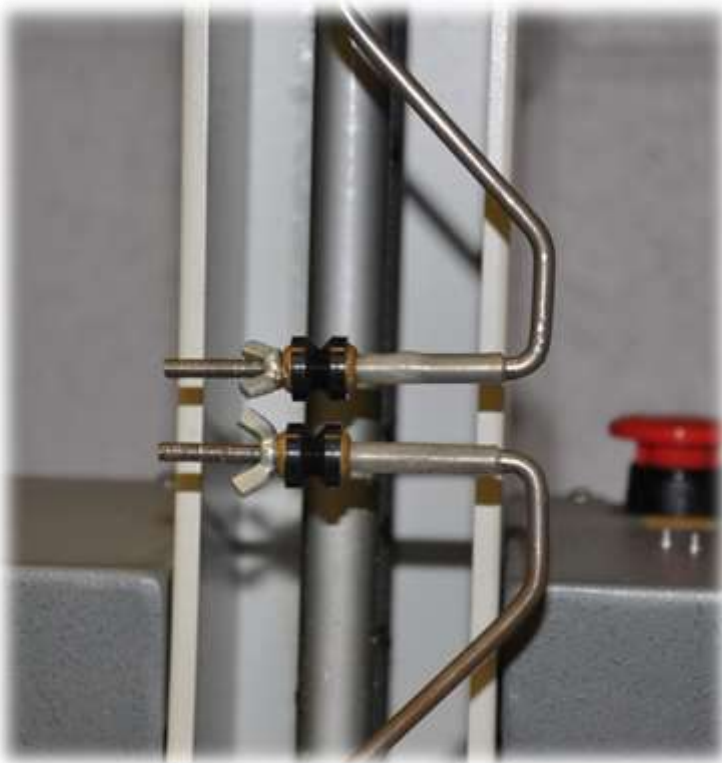
- Tensile testing
- Thermal conductivity testing
- Electrical conductivity testing
- SEM analysis
- Thermal microscopy
- TGA analysis.
- Fiber trace analysis

Important tests:

- Tensile testing
- Thermal conductivity testing
- Electrical conductivity testing

# Tensile Testing of Fibers

## First method used: Custom Setup



# Tensile Testing of Fibers

## Current method used:

Dynamic Mechanical Thermal Analyzer(DMTA)

**Manufacturer:** Rheometric Scientific

**Type/Model:** DMTA V

**Temperature Range:** Ambient to 500°C (without LN2) /-150°C to 500°C (with)

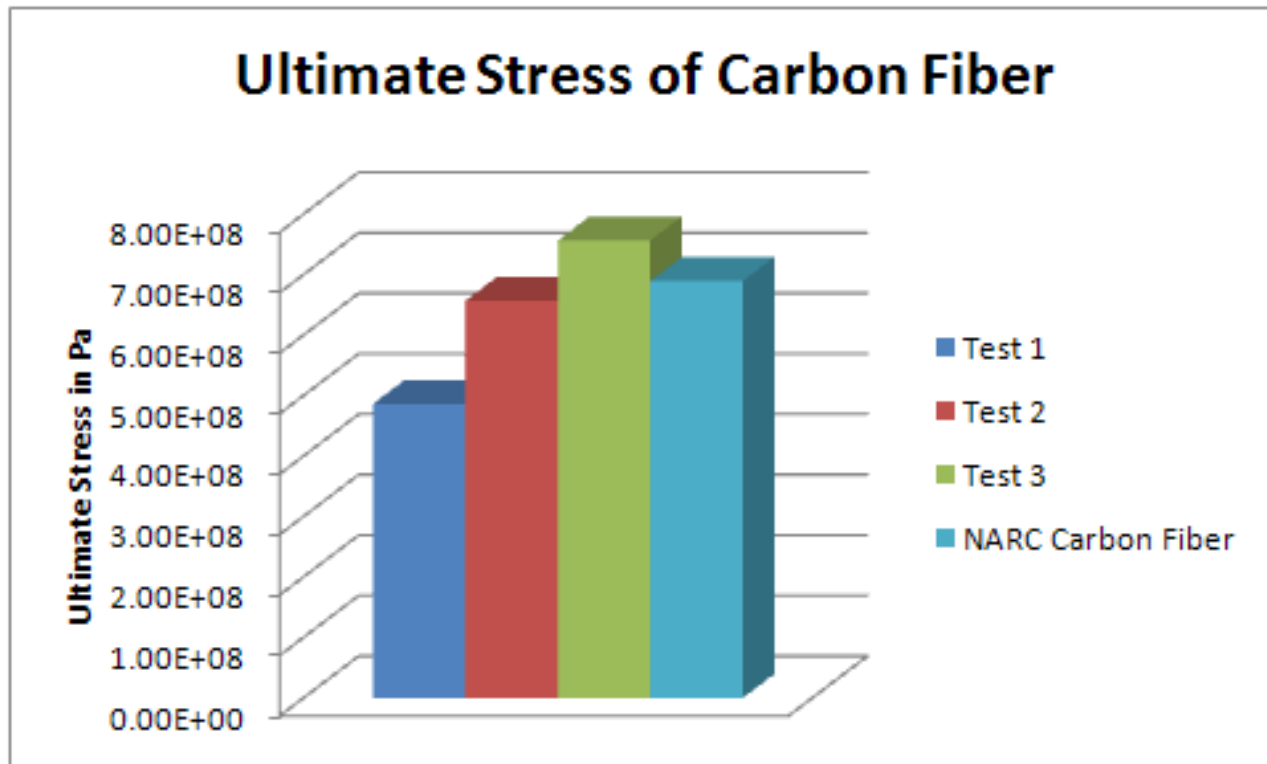
**Frequency Range:**  $1.0 \times 10^{-6}$  to 200 Hz

**Displacement:** +/-  $2.5E^{-4}$  to +/- 0.128 mm with a total force of 15N



# Comparison of carbonized NARC and ILCF

## Tested using DMTA



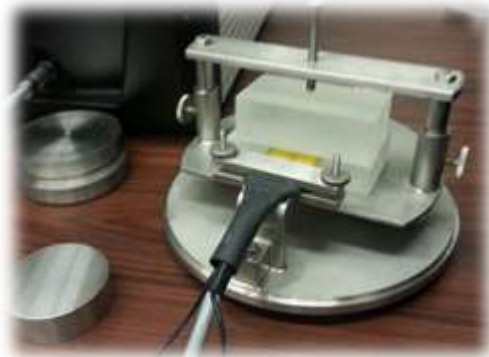
Ultimate Stress: Stress at which fiber breaks



# Thermal Properties Testing

## Performed using a Thermal Constants Analyzer

**Manufacturer:** HotDisk  
**Type/Model:** TPS 2500 S  
**Thermal Conductivity:** 0.005 to 1200 W/mK  
**Thermal Diffusivity:** 0.1 to 700 mm<sup>2</sup>/s  
**Measurement Time:** 1 to 1280 seconds  
**Reproducibility:** Typically better than 1%  
**Accuracy:** Better than 5%  
**Temperature Range:** -253°C to 1000°C

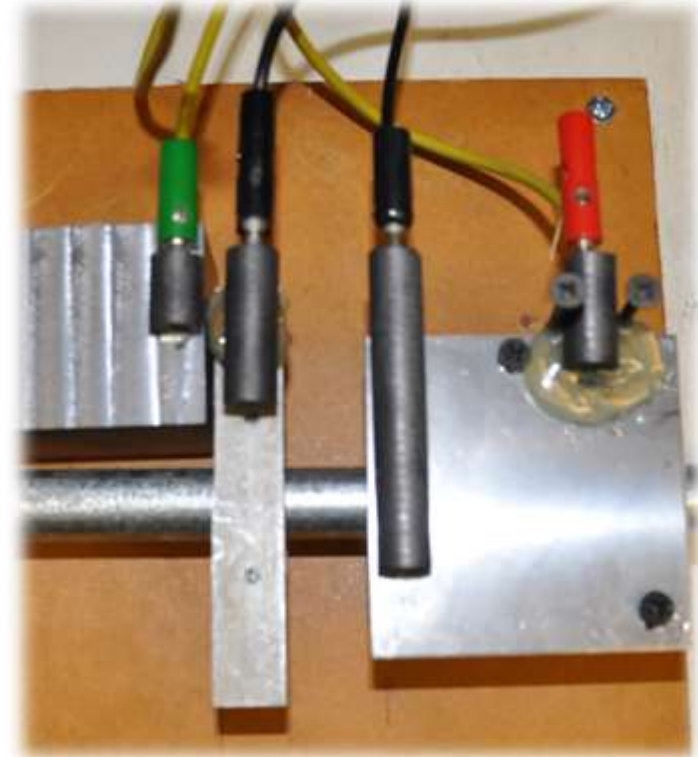


# Electrical Conductivity Testing

## Method used to Supplement Thermal Conductivity Tests:

### Custom setup

- 4 point electrical resistivity measurement
- Uses high precision multimeter
- 4 contacts with fiber
  - Two outer contacts supply current
  - Two inner contacts measure voltage at a distance between those two contacts.



## Recap:

- NARC fiber needs to be replaced.
- Ionic Liquid Fiber is one possible solution.
- Tests can be used to compare fibers:
  - Tensile testing
  - Thermal conductivity testing
  - Electrical conductivity testing

# Questions?

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