Greene, Tweed Composite Technology

Comparison between AR® and Thordon® materials




PetroChem & Power

Thordon® Materials Background

- Advanced polymer alloy introduced 25 years ago
- Originally developed for the Marine industry
  - For applications like rudder bearings where large clearances are not a concern

Benefits of AR® vs. Thordon® SXL

- Lower moisture absorption
  - Thordon has 1.3% moisture absorption which increases as the temp. increases
  - Thordon hydrolysis above 60°C / 140°F
- Easier to apply – run with smaller clearance
  - AR 1's clearance is easy to set and will not move in applications in its temperature range
  - Thordon's hydrolysis takes 4 to 6 months
    - So you have to run with a large clearance during that span until it completely grows in
    - This will make a vertical pump run with higher vibration during that period which could lead to premature failure or problems

Benefits of AR® vs. Thordon® SXL

- Higher temperature capabilities
  - 60°C / 140°F with water and chemicals for Thordon
  - 120°C / 250°F for AR HT
- Better abrasive resistance

Benefits of AR® vs. ThorPlas®

- ThorPlas overview
  - Thermoplastic material launched in 2004/2005
  - Self lubricating
  - Dry start up capabilities
  - Improved temperature capabilities up to 110°C / 230°F dry
  - Improved chemical resistance over other Thordon grades
- Drawback
  - Not suitable for abrasive applications

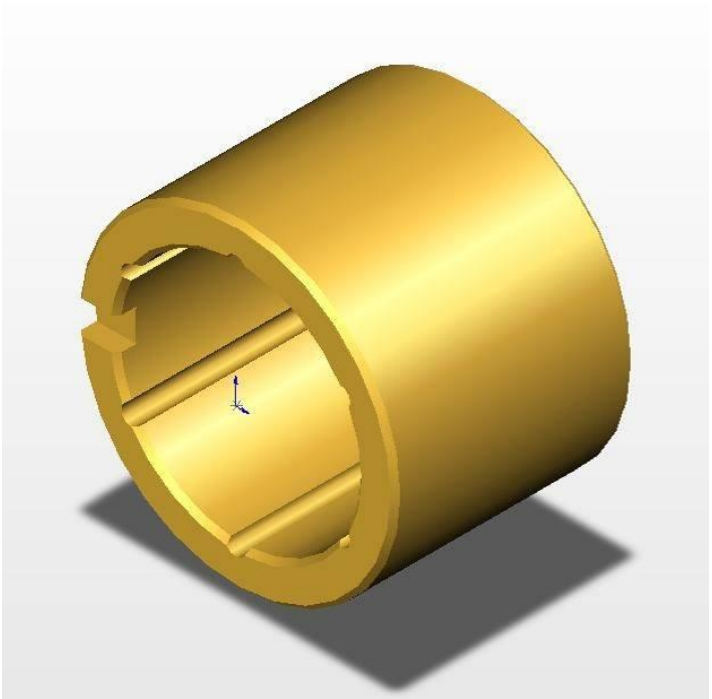
Abrasion Testing Goal

- Determine the abrasion induced ***wear rate*** of AR 1 and AR HT relative to other commonly used wear materials
- Determine the abrasion resistance of the shaft relative to the wear material
- Test Procedures/Conditions:
  - Materials subjected to identical test conditions (speed, load, temperature, media and test rig)
  - Specimens weighed before and after testing
  - Findings expressed in terms of the percentage of weight loss per hour

Abrasion Testing – Test Commonalities

Bearing Geometry

OD = 50 mm (2.000”)
ID = 38 mm (1.500”)
Length = 38 mm (1.500”)
- 6 Axial Grooves
- 1 Keyway Slot



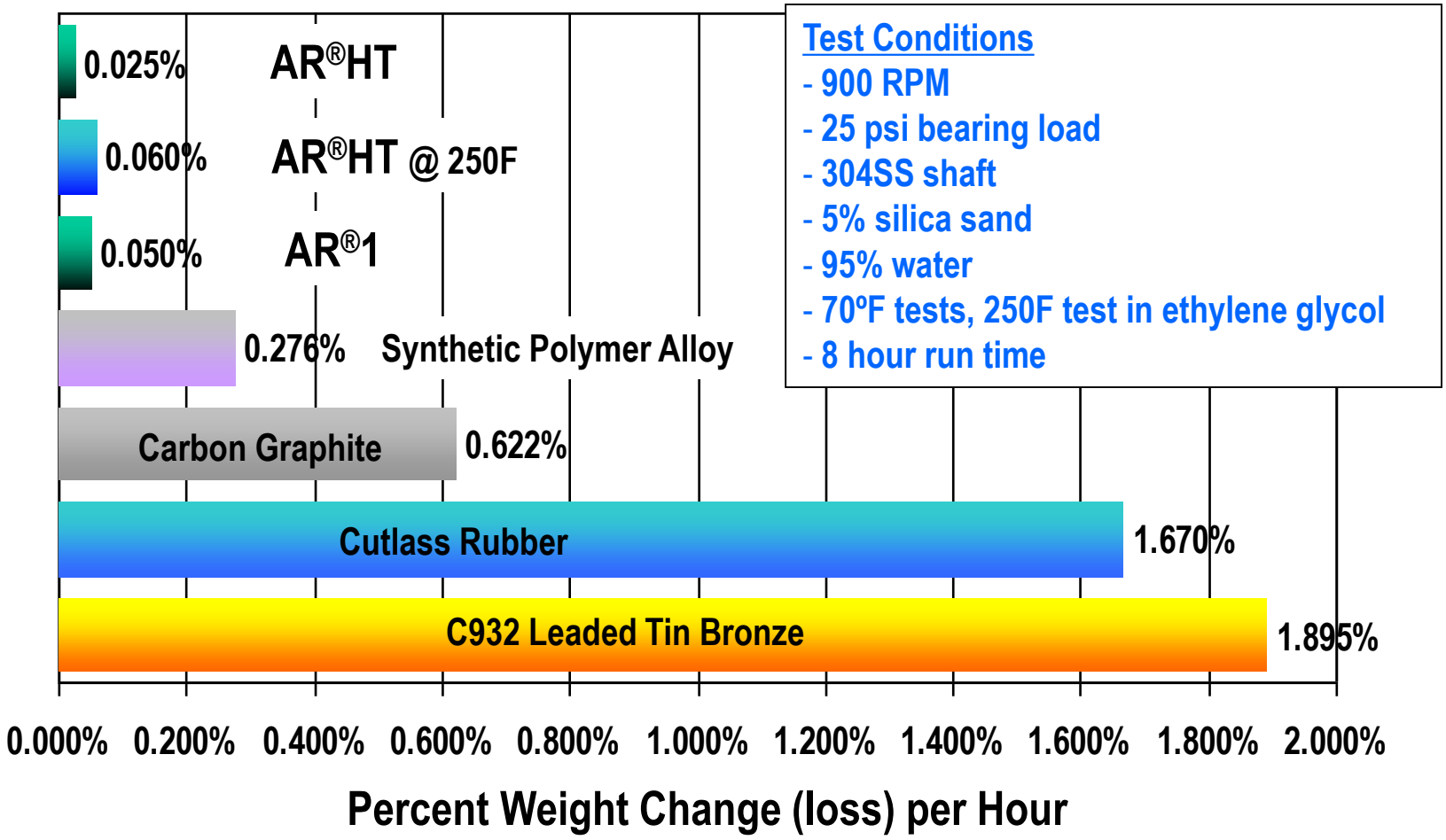
Calculation of Wear Rate

Density = (Weight before / Volume before)
Volume after = (Weight after / Density)
Wear Rate = (Volume Change / Total Hours Run)

Test Stand - Coupling and Bearing Assembly

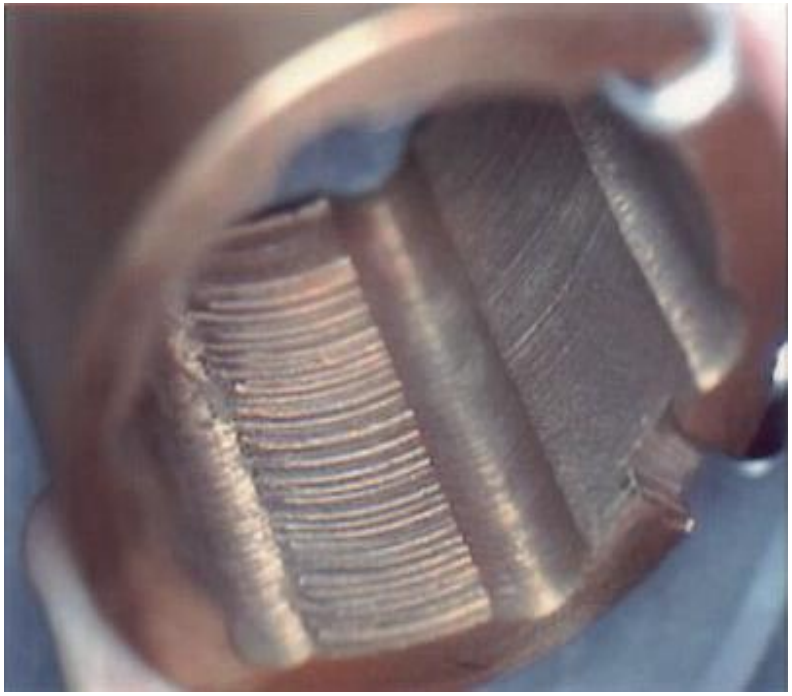
Test Stand - Bearing Housing & Flywheel

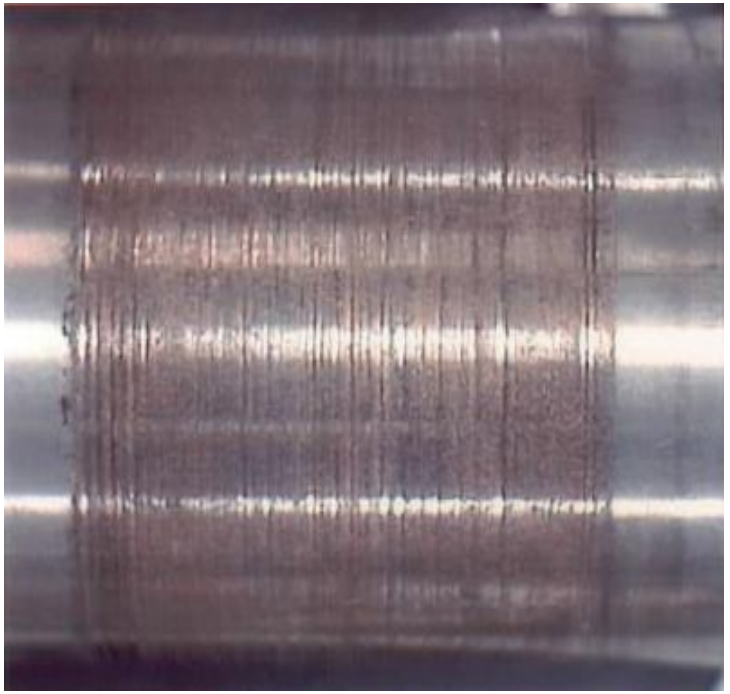
Comparative Table



Comparative Results

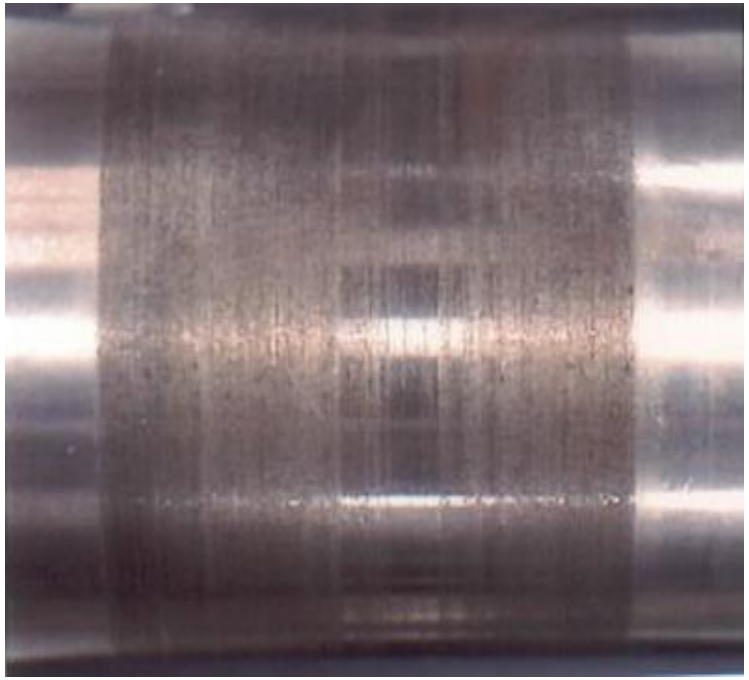
C932 Leaded Tin Bronze
304 SS Shaft





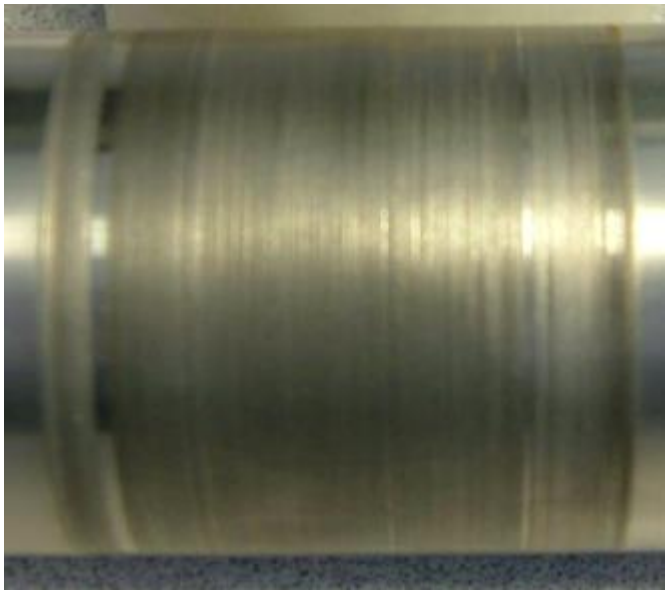
Comparative Results

Carbon Graphite
304 SS Shaft



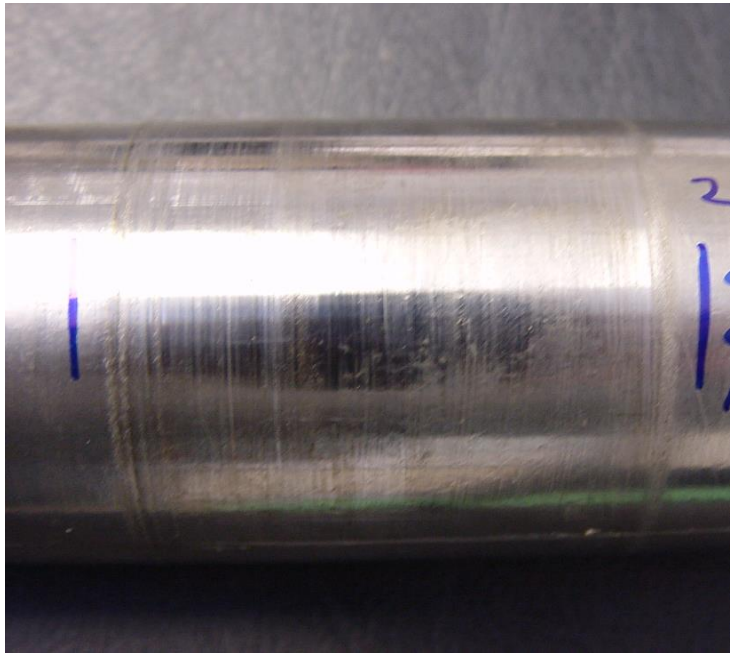
Comparative Results

Synthetic Polymer Alloy
304 SS Shaft



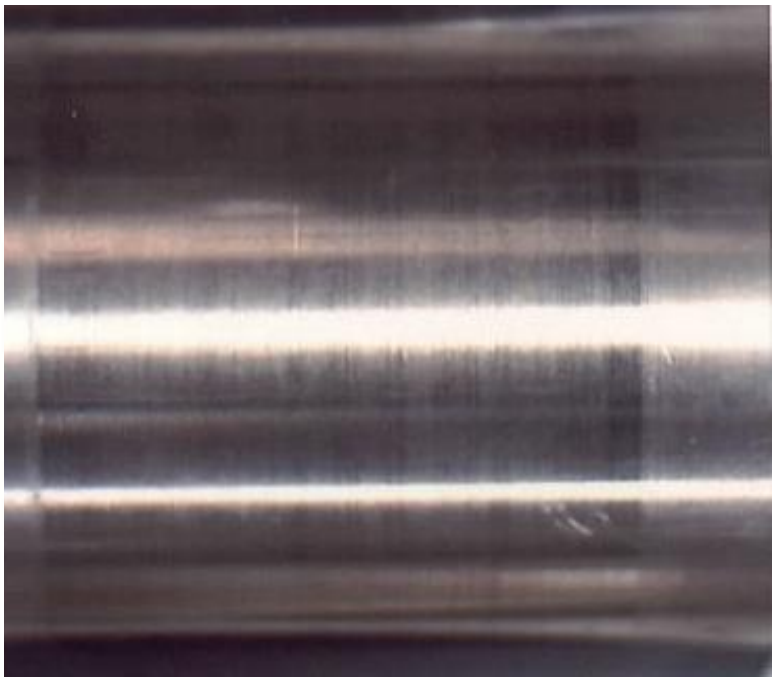
Comparative Results

Abrasion Resistant AR®HT
304 SS Shaft



Comparative Results

Abrasion Resistant AR®1
304 SS Shaft



Case History 1: Circulating Water Pump

- Location: US East Coast power plant
- Application: Circulating water pump
- Problem: Seizure at start up - Wear of ID
- Root cause: Thordon swelled onto the shaft
- Implication: Cost $1M per day
- Proposed solution: AR1
- Benefits: AR1 shows no moisture absorption

Case History 2: Screen Wash Pump

- Location: US power plant on Delaware river
- Application: Screen wash pumps
- Problem: High level of vibrations leading to premature cutlass rubber and Thordon bearings failures
- Root cause: High amount of abrasives (phragmites)
- Implication: Pump needs to be stopped
- Proposed solution: AR 1
- Benefits: Increased reliability
  - AR 1 survived the worst “phragmite season” ever without a single failure reported out of 17 pumps