High Strength

Corrosion resistant

Non-porous / Frost resistance resulting from non absorbing property

Good adhesion to essential construction materials – Steel

High abrasion resistance

High surface smoothness

Non conductive / good electrical insulation values

High Tensile strength

High Flexural Strength
The principal advantages of polymer concrete products include:

- **Increased physical properties** such as higher compressive, flexural and tensile strengths with a corrosion resistant matrix throughout the wall cross section.

- There are **no secondary** linings to connect to or coatings to apply during the manufacturing or installation process.

- In cases where the use of **conventional** steel reinforcement is either required or desired, polymer concrete can be designed with well known and accepted rigid pipe design methods such as ASTM C-76.
WHAT IS POLYMER CONCRETE?

It is a resin based precast product that is manufactured with conventional concrete precast practices and procedures (forming and equipment).

Products are similar to conventional concrete in that they contain selected blends of aggregates and fillers, which are held together utilizing a binder.

However, conventional concrete uses a combination of cement and water for the binder, while our polymer products use thermosetting resin blends in place of water and cement for the binder.

Our product can be reinforced using precast concrete industry standard methods (rebar / wire).

PolymerCrete™ is a corrosive resistant rigid design precast product that is ideal for both new and rehab construction projects.
## Mechanical Properties of Polymer Concrete

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Test</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>ASTM C-579</td>
<td>8,000 to 12,000 psi</td>
</tr>
<tr>
<td>Shear Strength</td>
<td>ACI 318</td>
<td>260 psi</td>
</tr>
<tr>
<td>Young’s Modulus</td>
<td>NA</td>
<td>1 to 2.4 X 10^6 psi</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM C-78</td>
<td>2,000 to 3,000 psi</td>
</tr>
<tr>
<td>Elastic Strain Limit</td>
<td>NA</td>
<td>0.014</td>
</tr>
<tr>
<td>Permeability</td>
<td>NA</td>
<td>Negligible</td>
</tr>
<tr>
<td>Porosity</td>
<td>NA</td>
<td>Negligible</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM C-307</td>
<td>1,200 to 2,000 psi</td>
</tr>
<tr>
<td>Splitting Tensile Strength</td>
<td>ASTM C-496</td>
<td>1,280 psi average</td>
</tr>
<tr>
<td>% Absorption</td>
<td>ASTM C-301</td>
<td>0.1%</td>
</tr>
<tr>
<td>% Acid-soluble Matter</td>
<td>ASTM C-301</td>
<td>0.0014 to 0.0019%</td>
</tr>
<tr>
<td>Manning’s Coefficient “N” Value</td>
<td>NA</td>
<td>0.009 to 0.012%</td>
</tr>
<tr>
<td>Freeze / Thaw Resistance</td>
<td>ASTM C-666</td>
<td>2,500 cycles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Density</td>
<td>NA</td>
<td>138 to 140 # / cu. ft.</td>
</tr>
<tr>
<td>Thermal Conductivity</td>
<td>NA</td>
<td>79 BTU/FT^2/FT/HOUR/°F</td>
</tr>
<tr>
<td>Dielectric Constant</td>
<td>NA</td>
<td>5.3 to 6.0</td>
</tr>
<tr>
<td>pH Service Range</td>
<td>NA</td>
<td>1 to 13</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>ASTM C-944</td>
<td>Applied load = 20lbf @ 3 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mass loss after 1st run = 0.003%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mass loss after 2nd run = 0.006%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mass loss after 3rd run = 0.008%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total mass loss = 0.008%</td>
</tr>
</tbody>
</table>
The purpose of the study was to investigate the materials resistance to a number of harsh chemical environments. The structural capabilities of the four materials examined in the study were tested following exposure to chemical environments for 90 days.

The study evaluated the corrosion resistance of Portland Cement Concrete (PCC), Silica Fume Concrete (SFC), Sulfur Concrete (SC), and ImpactPolymer polymer concrete (PC). Chemicals used in the study were Sulfuric Acid (25%), Hydrochloric Acid (10%), Nitric Acid (5%), Ammonium Nitrate (20%), 10,000 ppm Chloride, and Hydrogen Peroxide (20%).
**Proof Loading of Refining Tanks**

Tank Size: 4.5’ X 4.5’ X 14’

Load applied: Specified base load of 96,000 #

Solution: Salt water solution of approximate density 69.5lb/cu ft

First test: Loaded to twice the specified proof load level with no visible damage

Second test: Loaded to 8.5 times base load then one corner cracked

Third test: Repaired the crack with our polymer mortar. Loaded to 9.5 times base load with no damage. Test was terminated because the applied load approached the safe working load of the test frame.
Pipe Loading Test

24” ID X 48” length with 2.25” wall thickness in the barrel and 1.5” wall thickness of the joint end / spigot.

The pipe failed at a compressive load of 1,211 kips (1.211 million pounds).

The failure mode was uniform local spalling of the reduced section of the pipe in the spigot area, adjacent to the compression ring.

The rated compressive strength of the spigot joint is 300 kips.

The specimen tested had an ultimate compressive strength slightly greater than four times the rated compressive strength.
### D-Load Testing

**Reinforced vs Non-Reinforced**

<table>
<thead>
<tr>
<th>Sample I.D.</th>
<th>D-Load to Produce 0.01-inch crack (cracking load)</th>
<th>D-Load to Produce Ultimate Load (Class IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>9,827 lbs/ft</td>
<td>12,000 lbs/ft</td>
</tr>
<tr>
<td>Sample 2</td>
<td>8,739 lbs/ft</td>
<td>12,000 lbs/ft</td>
</tr>
<tr>
<td>Sample 3</td>
<td>9,630 lbs/ft</td>
<td>12,000 lbs/ft</td>
</tr>
<tr>
<td>Average</td>
<td>9,398 lbs/ft</td>
<td>12,000 lbs/ft</td>
</tr>
<tr>
<td>Sample 4</td>
<td><strong>25,271 lbs/ft</strong></td>
<td>12,000 lbs/ft</td>
</tr>
</tbody>
</table>

**NOTE:**

Same wall thickness and length for all samples

Steel area used for sample four per “B” Wall Class III ASTM C-76

Samples 1, 2 and 3 **do not** have steel reinforcement

Standard “B” wall class III ASTM C-76 standard concrete pipe performance equals - 8,000 lbs/ft = Class III Ultimate with 5,400 lbs/ft = Class III D-Load to 0.01 crack

Testing performed at Stork Southwest Lab of Houston Texas.
Rebar “Pullout” Test

Failure occurred when rebar failed in tensile
Research Affiliations

Waterways Experiment Station (WES), Vicksburg, MS. U.S. Army Corp. of Engineers
Construction Engineering Research Laboratory (CERL) U.S. Army Corp. of Engineers
Stork Southwest Labs
Maxim Technology Laboratory
Law Engineering
Battelle laboratory
Center for Advanced Technology Development (CATD)
U.S. Department of Energy (DOE)
Idaho National Engineering Laboratory (INEL)
Lockheed Idaho Technologies Company (LITCO)
Iowa State Innovation Systems (ISIS)
Iowa State University Civil Engineering Dept
Iowa State University Mechanical Engineering Dept.
Iowa State University Nuclear Engineering Program.
# Markets Served

## Underground

- Sanitary Sewer
- Structures
- Tunnel Pipe
- Water Treatment

## Industrial

- Energy – Petrochemical
- Mining & Refining industry

## Federal

- General Construction
- Containment Energy & Federal
- Bridge Retrofit

![Image of Polymer Concrete Effluent Storage Tank: LxWxH = 48m x 10m x 4.5m](image-url)
Underground

Sanitary Sewer Pipe
✓ Direct Bury
✓ Jacking
✓ Microtunnel
✓ Slipline

Structures
✓ Manholes
✓ Flow Structures
✓ Lift Stations
✓ Box Culverts

Tunnel Pipe (large diameter)
✓ Tunnel Segments
✓ Shafts
✓ Liner Pipe

Water Treatment
✓ Pipe
✓ Structures
✓ Containment
✓ Trench
Industrial Market

Energy – Petrochemical / Oil Platforms
✓ Corrosion Resistant Precast and Pipe

Mining and Refining Industry
✓ SX EW Cells (tanks), Trench, Sumps, Columns and Beams
Federal Market

General Construction
✓ Blast Panels
✓ Homeland Security Upgrades

Containment Energy & Federal
✓ Low Level Radioactive
✓ Mixed Waste Containment

Bridge Retrofit
✓ Bridge decks and ramps
Sanitary Sewer

Overview
Pipe products to service the sanitary sewer industry
• Flush bell trenchless pipe
  ➢ Microtunnel
  ➢ Jacking pipe
  ➢ Pilot tube pipe
  ➢ Kite shape pipe
• Open cut / direct burial pipe
  ➢ Bell end pipe
  ➢ Flush bell pipe
  ➢ Kite shape pipe
• Tunnel segments
  ➢ Large diameter single pass tunnel segments

Target Market
• Sanitary sewer industry
• Process and refining industry
• Industrial applications
Sanitary Sewer

Pipe

Key Partners

- Local and regional manufacturers
- Industry engineering firms
- Municipalities / owners
- Direct sales and marketing
- Partnering with contractors on design-bid-build projects
Sanitary Sewer

Manholes, Shafts and Structures

Overview

Products to service the manhole and structures industry
• Industry standard 48”, 60”, 72”, 84”, 96” and 120” inside diameter manholes
• Custom diameter manholes such as 144” and greater
• Structures that may be boxes, vertical segments, vaults,…etc.
• Lift stations, junction structures and wet wells
• Intermediate platforms, transitions, base structures, cones and flat top lids

Target Market
• Sanitary sewer industry
• Process and refining industry
• Industrial applications
• New construction and rehab projects
Sanitary Sewer

Manholes, Shafts and Structures

Market

Key Partners

- Local and regional manufacturers
- Industry engineering firms
- Municipalities / owners
- Direct sales and marketing
- Partnering with contractors on design-bid-build projects
Mining and Refining
Process Cells and Tanks (Copper)

Overview

Products to service the Mining and Refining Industry
- SX&EW Cells (tanks)
- Trench and sump systems
- Columns and beams cell elevation platforms
- Panelized systems
- 16% sulfuric acid at a constant temperature of 160 degrees Fahrenheit
Mining and Refining
Cable, Utility Box Enclosures and Pump Pads

Enclosures

Overview
Products to service the cable and utility industry
Formwork Example

- Header Ring (top)
- Pallet Ring (bottom)
- Core with steel
- Core (center form) and Jacks (outer forms)
- Inside release cam system
- Outside form jacks (half side)