Understanding the Interaction between PPR and Copper Pipes in Water System

Exploring Compatibility Challenges and Solutions

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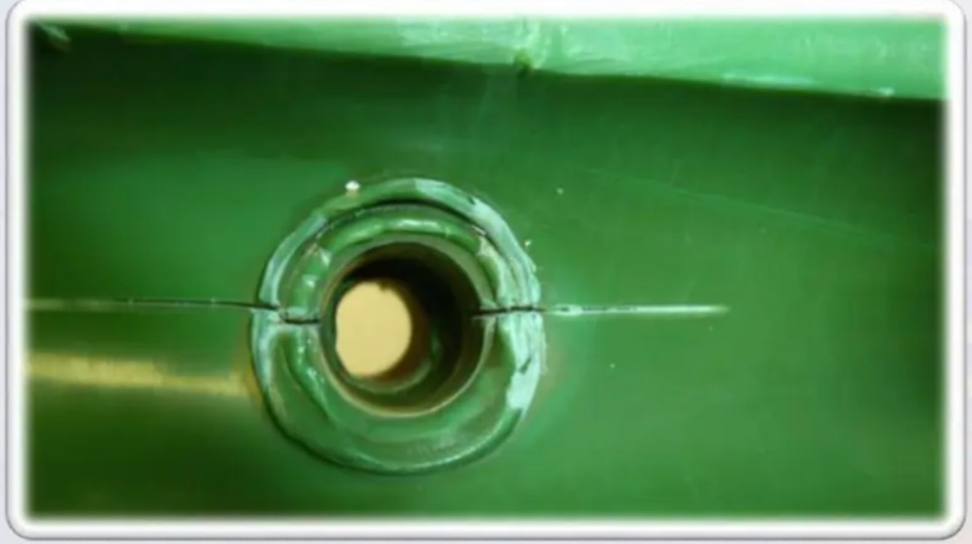
Introduction

In this presentation, we will explore the potential degradation of PPR pipes when combined with copper pipes in hot water systems. We will explore into the leading causes of failure, including galvanic corrosion, chemical interactions, and thermal effects, and discuss preventive measures to ensure the integrity and longevity of plumbing infrastructure.



ENOVA by VEOLIA

What is PPR and Copper?

Polypropylene Random, are a type of thermoplastic piping commonly used in plumbing systems. These pipes are known for their high temperature resistance, chemical durability, and ease of installation.

Despite their individual advantages, combining PPR and copper pipes in the same plumbing system poses challenges due to differences in material properties and compatibility issues.

Copper are a traditional choice for plumbing systems due to their excellent thermal conductivity, corrosion resistance, and durability. These pipes are typically used for potable water supply, HVAC systems, and refrigeration applications.

Degradation Challenges

Chemical Interactions:

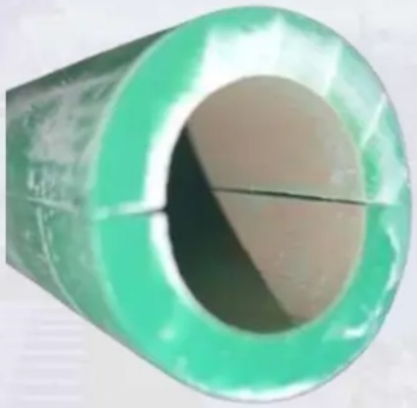
Chemical reactions can occur between PPR and copper pipes when exposed to substances in the water supply, such as chlorine or other disinfectants. These reactions may result in degradation of the pipe materials and the formation of corrosion by-products.

Impact: When Chlorine is added to water, it transforms to hypochlorous acid, which is capable of breaking the carbon-to-carbon bonds of PPR's polymer chain

Thermal Effects:

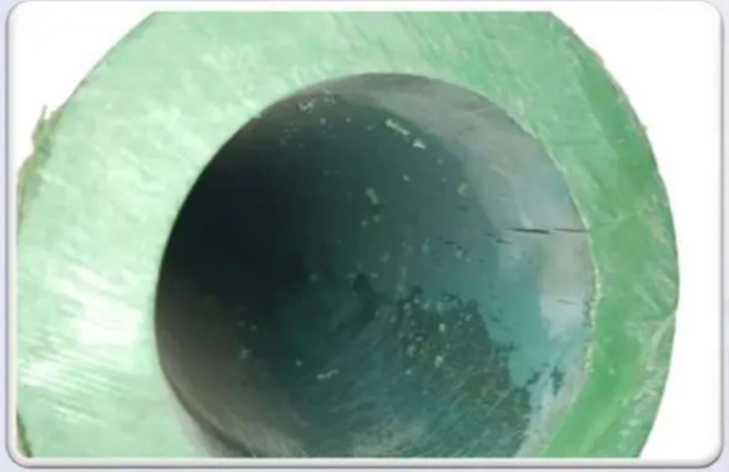
Heat is an accelerant for corrosion. Over time, the susceptibility of a piping materials to corrosion is only going to increase when exposed to hot water. In the case of PPR, the chlorine or chlorine dioxide used to disinfect water corrodes the piping material.

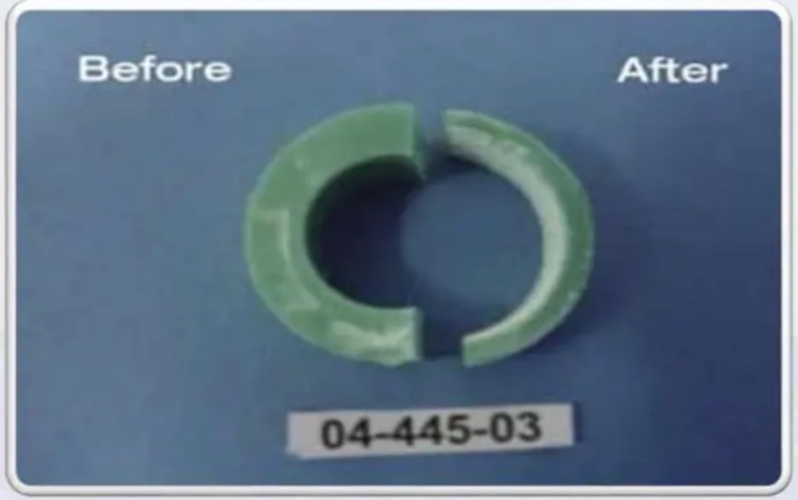
Impact: Thermal effects can compromise the structural integrity of the piping system, resulting in leaks, failures, or the need for frequent repairs.



Galvanic, Thermal and Chlorination Effects

The image below shows the effects of hot chlorinated water on PPR pipe, with significant corrosion of the pipe wall after only 10 months (5PPM of chlorine).

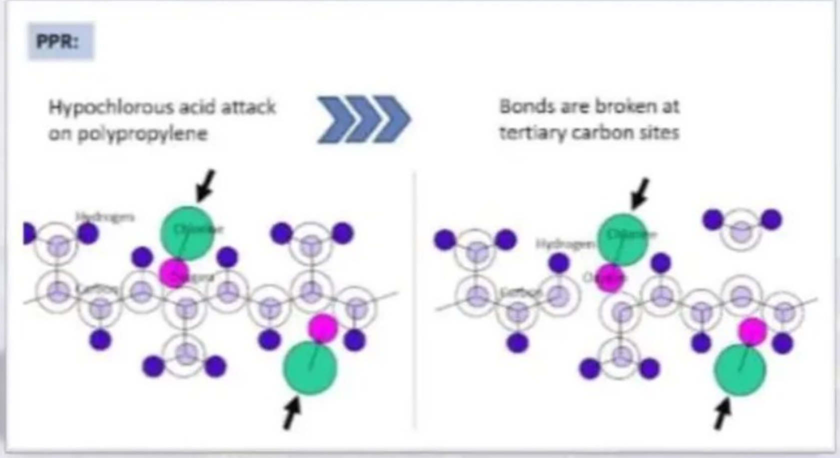


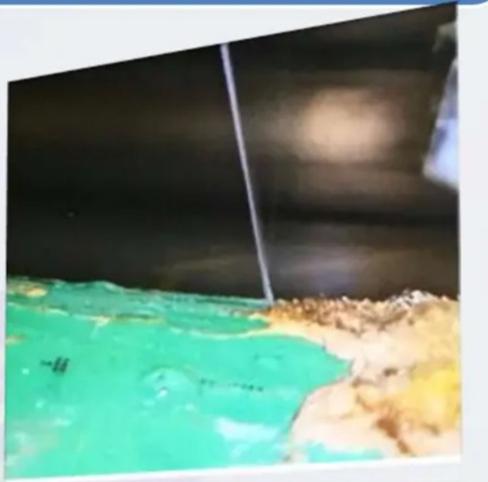


Buildings with a copper hot water recirculation system which experience high greatly accelerates degradation in the PP-R systems.

Related Research Findings

The expert results and external studies concluded that the the combination of excessive temperature, pressure and coupled with attendant chlorine and aggressive copper ions all constantly recirculating at high velocity and stimulated by entrained air were found to be the causes of the chemical cocktail causing the PP-R systems to suffer degradation when associated with a hot water recirculation system.





Release of free ions is accelerated with higher velocity flows, elevated temperatures and with use of strong oxidants such as traditional chlorine and especially using increasingly becoming popular chlorine dioxide.

DON'T MIX COPPER WITH PPR!

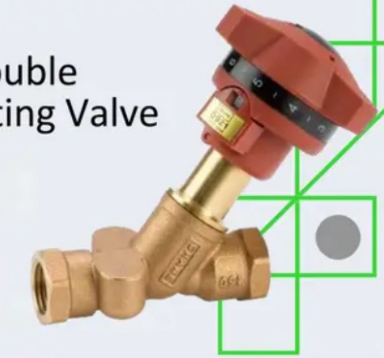
Solution & Preventive Measures

1. **Proper Installation:**
   - Use appropriate brackets, supports, and hangers to minimize stress on PPR pipes.
   - Skilled technicians following manufacturer's guidelines for fusion techniques and joint connections.
2. **Temperature and Pressure Management:**
   - Install temperature and pressure relief valves to prevent exceeding recommended limits (>60˚C).
   - Ensure expansion joints are installed to accommodate thermal expansion and contraction.
3. **Water Velocity Control:**
   - Install flow restrictors, control valves, or pressure regulators to regulate water velocity and reduce erosion.
   - Use water hammer arrestors to mitigate sudden pressure surges.
4. **Material Compatibility Consideration:**
   - Select PPR pipes and fittings designed for hot water applications with built-in metal deactivators.
   - Use compatible materials for connectors, valves, and other accessories, such as brass or stainless steel.
5. **Regular Maintenance:**
   - Conduct routine inspections to detect any signs of degradation, leaks, or damage.
   - Replace worn-out or damaged accessories promptly to prevent further deterioration.
6. **Water Treatment:**
   - Implement water treatment methods, such as filtration or chlorination, to control water quality and minimize chemical degradation.

Plumbing Accessories

Pressure
Reducing Valve

Double
Regulating Valve



Flexible
Connection

Pressure
Relief Valve

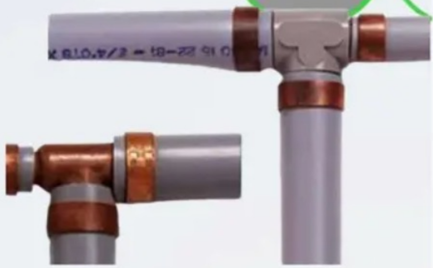
Automatic Air
vent

Water Hammer
Arrester

Pipe Materials Comparison

Piping Material	Maximum Operating Temperature	Estimated Lifespan	Cost	Resistance to Copper Ions	Resistance to Chlorine at High Temperatures
PPR (Polypropylene Random)	Up to 180°F (82°C)	50+ years	Mid	No	No
Polybutylene (PB)	Up to 180°F (82°C)	20-30 years	Low	No	No
PEX (Cross-linked Polyethylene)	Up to 200°F (93°C)	50+ years	Low	Yes	Yes
CPVC (Chlorinated Polyvinyl Chloride)	Up to 200°F (93°C)	50+ years	Mid	Yes	Yes
Multilayer Pipes	Up to 200°F (93°C)	50+ years	Mid-High	Yes	Yes
Copper	Up to 400°F (204°C)	50+ years	High	Yes	Yes
Stainless Steel (SS)	Up to 1292°F (700°C)	50+ years	Very High	Yes	Yes







Alternative Pipe Materials

PPR (Polypropylene Random)

Polybutylene (PB)

Multilayer Pipes

CPVC (Chlorinated Polyvinyl Chloride)

PEX (Cross-linked Polyethylene)

Stainless Steel (SS)

Copper

Thanks!

ANY QUESTIONS?