Material Performance

By Donald Townley

The Ultimate Test of a CPVC Piping System

When choosing a CPVC material for use in pressure piping systems, it is not only important to consider short-term material performance but it's critical to consider the long-term elevated pressure performance that the CPVC pipe, fittings and valves will experience in real-world applications. Before deciding which piping system to select, keep in mind the performance measurements of the material that truly reflect upon the lifetime performance expectations of the products produced from these materials.

Short-term vs. Long-term Performance Measures

The CPVC material cell classification simply signifies the short-term physical properties of that material. The impact resistance cell classification does accurately express pipe and fitting impact durability important throughout installation. However, the tensile strength and tensile modulus of elasticity cell classifications at room temperature do not reflect upon the continuous elevated pressure and temperature strength requirements of the pipe and fitting materials. Any claim that an increase in room temperature tensile strength indicates a stronger continuous elevated temperature and elevated pressure performance is misleading and inaccurate.

More relevant to the performance of these products over time are the results of the long-term stress rupture tests as specified in ASTM D2837 and obtained through the Plastic Pipe Institute (PPI) Hydrostatic Stress Board in accordance with PPI TR-3. These tests determine both the room temperature and elevated temperature long-term strength of the material. The hydrostatic design strength or HDS of materials, and in turn the pressure bearing capability over time of the pipes and fittings produced from these materials, are determined from these tests. Since 1958, qualifying the pressure and strength of thermoplastic materials through the PPI Hydrostatic Stress Board has been a proven and industry-accepted method to assess the long- term properties of polymers used in elevated temperature, pressure pipe systems.

It is important to understand that PPI designates "Standard Grade" materials to indicate the highest tier of confidence that one can have in the performance of a thermoplastic material as tested using a widely accepted protocol. By contrast, materials with an "Experimental Grade" designation have only performed for a fraction of the required time as a Standard Grade material under the same test conditions. CPVC pipe and fitting materials having a PPI listed, Standard Grade HDB will have demonstrated long-term strength performance that is understood and predictable. Accordingly, this reflects upon those pipe and fittings produced from these materials.

Lubrizol is the only supplier of PPI pressure-rated, Standard Grade compounds used for valves and fittings. In addition, Lubrizol is the only supplier of CPVC compounds with a 1250 psi Standard Grade HDB. CPVC pipe and fitting materials having a greater Standard Grade HDB will deliver long-term strength behavior outperforming that of a similar product manufactured from materials having a typical 1000 psi Standard Grade HDB.

Performance vs. Manufacturing

Despite the positive effect of good manufacturing techniques, or high-quality mold and die design, superior CPVC materials will in turn yield better performing products. When considering the importance of product reliability over a lifetime, CPVC pipe and fitting materials having a superior PPI listed, Standard Grade HDB classification have a true advantage in meeting the long-term demands of the products made from these materials. Ultimately, the best performing CPVC pipe, fittings and valves can only be produced from the highest performing CPVC materials and employing the best manufacturing practices.

About the Author

Donald Townley, PE, is the Global Manager of Codes and Approvals for the Lubrizol CPVC piping systems and materials business of The Lubrizol Corporation. He holds a BSME from the University of Cincinnati and is a licensed professional engineer. Townley has been active in code development activities, presenting numerous code changes to both the UPC and IPC. He is a current member of numerous ASTM, ASME and CSA committees and a former member of the NFPA Technical Committee on Residential Sprinkler Systems and the IAPMO Standards, Uniform Mechanical, and Uniform Plumbing Code Committees.

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