PVC PIPES TECHNOLOGY

PVC pipe has been proven excellent for customer use in many aspects. Nowadays, PVC pipe innovations are continuing, widening its applications as exemplified below.

Oriented PVC (PVC-O) [12,13]

Made by realigning the PVC molecules through a process of biaxial orientation. This greatly enhances the material properties at around twice the strength and ten times the impact resistance compared to traditional un-plasticized PVC (PVC-U) material. The wall thickness of PVC-O pipes can be reduced by up to 50% while maintaining the same pressure as that of the traditional PVC pipe. PVC-O pipes have been produced and used in Australia for over 20 years and Australia has been at the forefront of these significant advances and has the largest PVC-O pipe manufacturing capacity in the world.

Modified PVC (PVC-M)

The alloy of PVC that incorporates an impact modifier to improves the fracture toughness and ductility of the material. This enhanced toughness enables PVC-M pipes to be manufactured with a thinner wall, with subsequent material savings and improved hydraulic properties. The alloying of PVC with modifying polymers achieves improvement in resistance to cracking [14], thus, minimizing the effect of stress concentrators such as scratches.

Chlorinated PVC (C-PVC)

Made from PVC for use as hot and cold water pipe, and industrial liquid handling. CPVC is significantly more ductile than its PVC counterpart, allowing greater flexure and crush resistance. Additionally, the mechanical strength of CPVC makes it a viable candidate to replace many types of metal pipe in conditions where metal's susceptibility to corrosion limits its use . [15]

Fusible PVC Pipe

PVC and High Density Polyethylene (HDPE) blend help facilitate the horizontal alignment of PVC pipe and improve mechanical strength of the pipeline. [16]

References:

(1) 2012 World Vinyls Analysis, Chemical Market Associates, INC. (CMAI)
(2) "Piping Geothermal Fluids, Chapter 10", Rafferty, Kevin, Geothermal Direct Use Engineering and Design Guidebook, Third Edition, Geo-Heat Center, Oregon Institute of Technology, Klamath Falls, OR, 1998.
(3) a)http://www.vinylindesign.com/mainmenu/UsesofVinyl/Pipe/News/PVCWaterPipesFoundSuperior.aspxb)"PVC piping: The ultimate underground solution", Modern Materials, November, 2003, pp. 7-9.
(4) "A little PVC goes a long way: The PVC cost advantage in construction", The European Council of Vinyl Manufacturers (ECVM); http://www.pvcconstruct.org.
(5) a) PVC Fact book Chapter 1, The Vinyl Environmental Council (VEC), Japan, 2008.
b) "Fire and Polyvinyl chloride", Technical information, The Vinyl Institute, 1996.
(6) Thermal Analysis of Polymer Flammability-The Final Report 2007, US Department of Transportation, Federal Aviation Federation.
(7) NSF/ANSI Standard 61 Overview; http://www.nsf.org/business/water_distribution/standard61_overview.asp
(8) a) "Straight Talk-Vinyl building materials and environment" The Vinyl Institute, September, 2000. b) "Water Main Break Data on Different Pipe Materials for 1992 and 1993",
b) Rajani and S. McDonald, , National Research Council, Ottawa, Ontario, Canada, 1995.
(9) "When performance counts: PVC pipe is the choice", UNI-PUB-10-04, The Vinyl Institute.
(10) "Recycling rigid and flexible PVC", Recovinyl, The European Council of Vinyl Manufacturers (ECVM), 2003.
(11) Collection and Recycling of plastics pipes in demolition and construction waste stream, A.J. Whittle, D. Pesudovs, Plastics Rubber and Composites, 2007, 36, 190-195.
(12) Model II delamination testing in uniaxially oriented PVC pipes, D.B. West and R.W. Truss, Journal of Material Sciences, 2004, 39, 2789-2794.
(13) Practical guide to Polyvinyl Chloride, Stuart Patrick, Rapra Technology Limited, iSmithers Rapra Publishing, 2005, 110-111.
(14) Effect of impact modification on slow crack growth in polyvinyl chloride, T.E. Bernal-Lara and Y. Hu, Journal of materials science, 2004, 39, 2979-2988.
(15) Chlorinated polyvinyl chloride, http://en.wikipedia.org/wiki/Chlorinated_polyvinyl_chloride
(16) Predictive modeling of installation loads for directional drilled fusible PVC pipe, S.T. Ariaratnam, R. Botteicher, A. Ghosh, K. Piratla and E. Vilfrant, Tunnelling and Underground Space Technology, 2010, 25, 766-772.

"PVC is the most Sustation, Environment-Friendly and Safe-to-Use Commodity Plastic in The ASEAN Community."

183 Rajanakarn Building, 14th Floor, Sathorn Road,
Yannawa, Sathorn, Bangkok 10120 Thailand
Tel : +66 2676 6000 Ext. 1791
Fax. : +66 2676 6001 Ext. 1791
www.aseanvinyl.org
ww.facebook.com/ASEANVinylCouncil

PVC PIPE

THE WISE CHOICE

PVC pipes and fittings are engineered to serve various piping applications by outperforming other piping materials from its outstanding properties and innovation. PVC is hence the best candidate for piping material in terms of conserving resource and energy, safe use and cost-price efficiency perspective.

PVC PIPES PERFORMANCE

Pipes and fittings are the main applications of polyvinyl chloride (PVC), and constitute over 43% of the usage of this plastic.[1] This includes water supply system, drainage system as well as agricultural pipes. PVC pipes have been widely used since the 1970's to substitute traditional pipe materials such as cast iron and clay pipes based on its outstanding performances as follows:

Lightweight - at the same thickness and diameter, the average weight of PVC pipe is only one-fifth of cast iron pipe[2] Its lightweight property facilitates the transportation between locations, hence, lowering the transportation cost. Likewise, less manpower and installation time are required for PVC pipe due to its lightweight.

Chemically-inert & corrosion resistance - this is superb in minimizing losses in main water systems. The United States encounters 2.2 trillion gallon loss of water a year due to leaks and broken water and wastewater infrastructure, costing roughly 36,000 million USD every year. The use of non-corroding PVC pipes dramatically reduced this loss. All states in USA approves the use of PVC pipe for plumbing since it could reduce the average cost of new homes by many thousands of dollars.[3]

Easy to install - PVC pipe is easy to install and maintain. Cutting and welding can be undertaken very easily once installed.

Favorable cost - an excellent cost price performance of PVC pipes result directly from their low maintenance and installation costs, long life-span and efficient waste management. The European Council of Vinyl Manufacturers (ECVM) conducted a research based on the total cost ownership approach (TCO) of drinking water and drainage pipes in Germany and Italy [4]. This approach considered the cost effectiveness of materials from the price once purchased and long term cost during usage. Results of the study show that durability and extremely long life, the low failure rate of PVC pipe can provide significant savings over the conventional concrete and iron networks.

Fire retardant - PVC is intrinsically fire retardant and self-distinguish when fire source is removed. This superior characteristic makes PVC a safe material for construction. In addition, PVC releases lower heat of combustion than other construction materials when burned [5,6].

Engineered for safe use - increasing public attention to water quality and health are additional factors favoring PVC use in piping applications. PVC pipe has been tested against the American National Standards (ANSI/NSF 61) and other health effect and drinking water standards for more than 35 years and has consistently performed better than the standards require[7].

Oxygen index of various plastics

Materials	Oxygen index
Polyetrafluroetylene	95.0
PVC	45~49
PC	45~49
Nylon 66	45~49
PET	20.0
PS	17.6~18.3
PP	17.4
PE	17.4

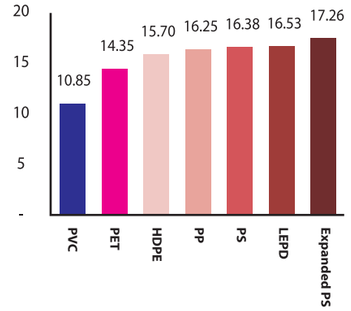
↑ Self-extinguishing plastics

Source : M.M Hirschier "Macromol. Chem." Macromol.Symp.Vol.29,p.133-153,1989

PVC PIPES SUSTAINABILITY

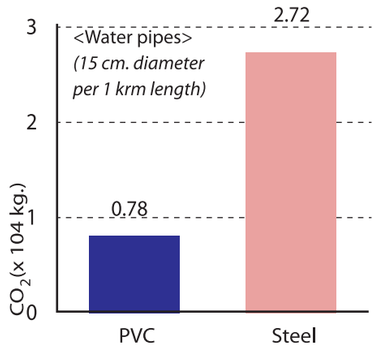
Energy efficiency - the manufacture of PVC pipe consumes much less energy than alternative materials for equal lengths of pipe. The lower consumption of energy accounts for lower emission of carbon dioxide (CO2) during manufacture and usage. Its durability characteristics helps preserve natural resouces. The National Research Council of Canada (NRC) found that the "break rate" for vinyl water distribution pipe was 0.5 breaks per 100 km (62 miles) per year as compared with 32.6 breaks per 100 km per year for cast iron. Lower break rates minimize the risk of contamination from leakage and provide major savings in time and resources[8].

Energy consumption up to the production stage of plastics



Source : Prepared from*A report on LCD data for petrochemical products, PWMI

Co_2 EMISSION UPON PRODUCTION



Source : Prepared from the survey report by Chem Systems

Long service life - PVC pipe has life span at least 40 years, and in some cases can reach 100 years, with little or no loss of its durability and strength from its virgin production. PVC pipes are designed and engineered as marginally flexible structures. The inherent benefit of PVC pipe is its ability to withstand point loading, differential settlement and ground movement.[9] Under similar pressures, rigid materials such as concrete are more likely to crack and fail.

Recyclability - Recycled PVC (R-PVC)[10,11] show little losses of strength and performance after recycling. Few additives amount or suitable mixing ratio with the virgin resin are practically carried out to restore equivalent performance of R-PVC. PVC recycling technologies are progressively developed to help confirm that it is environmentally benign and results to resource conservation.