FOAM INSULATION

SOCIETAL IMPORTANCE

Growth in thermal insulation foams continues to be driven by increasing energy efficiency requirements in appliances, transport applications, and buildings. Buildings (as an example) account for over 40% of the world's total primary energy consumption and 24% of global carbon dioxide (CO_2) emissions[1]. One of the more effective strategies to lower energy consumption and improve energy efficiency is to increase the use of thermal insulation[2],[3].

Polyurethane (PU) and extruded polystyrene (XPS) foams and other types of foam insulation products are used to attain high energy efficiency in buildings while reducing CO_2-equivalent emissions from the building heating and cooling. These insulation products utilize "foaming agents" or "blowing agents" to create the "cell size" within a given insulation product and it is this cell structure that delivers the insulating value of the foam. There are 16 major types of insulating foams produced globally that are primarily used for appliance insulation, residential and commercial building insulation, and specialty applications such as refrigerated storage, transport, and pipe insulation.

Critical Application Considerations

In a 2007 McKinsey study that analyzed the cost vs. the benefit of potential programs that will save greenhouse gases, "building insulation" ranks as one of the best opportunities for abatement. Foam insulation is one of the key contributors for this because of its unique attributes. The results show that while manufacturing foam insulation consumes energy, the energy saved far exceeds HFC manufacturing energy consumed, plus the direct blowing agent contribution.

Energy efficiency in buildings is heavily influenced by the choice of blowing agent. For example, non-ozone-depleting **HFCs can currently produce 10%-100% more efficient foams compared to other materials at the same mass and thickness.** HFCs are man-made chemicals that were mainly developed as alternatives to ozone-depleting substances and are used as foam expansion agents (FEAs). Insulation materials utilizing HFC technology are high performance products that exhibit significant insulation (or R) values per thickness, thus providing cost-effective solutions to the building industry as it looks to substantially increase the energy efficiency of both new and existing buildings.

Environmental Considerations

The current landscape of technology choices is complex and is dependent upon the specific foam insulation sector, regional climate differences, availability of technology, and many other variables.

Solely using GWP as selection criteria for foam blowing agents could lead to the selection of alternative technologies that provide a reduced R-value and over time would result in more GHG emissions than would be emitted from the foam insulation itself. In other cases, alternatives may have properties that would preclude their use in certain applications. Based on these factors (among others) energy efficiency needs based on a Life Cycle Climate Performance (LCCP) approach should be a primary driver in determining the most appropriate foam technology options as there continues to be pressure to improve the overall thermal performance of foams across multiple use sectors.

Technology Trends

As of 2010, HCFC phaseout was virtually complete in all developed countries and HFCs have made this transition possible without the loss of thermal performance in buildings or appliances. While efforts continue to evaluate potential alternatives, these need to be balanced against the resources used to complete the most recent transition(s) as these evaluations will take time and additional resources associated with a demanding product range and a variety of manufacturing processes.

Although hydrocarbons continue to be the primary solution in several applications in developed countries, there is increasing pressure in several application sectors to further optimize the foaming agent technology by blending multiple technologies. **In developing countries, decisions need to be made to meet HCFC phaseout management plan initiatives.** Within several sectors, previously identified low-GWP alternatives to HCFCs have yet to be fully validated and/or will require a significant transition investment.

Looking Forward

There continues to be a need to characterize the performance of foams made from low-GWP alternatives in a wide range of applications. This is an on-going exercise, but is particularly important for technologies that do not have a significant use history. Key drivers in this effort will continue to be both regulatory and socio-economic across both developed and developing countries.

As new lower GWP foaming agent technologies continue to be evaluated, **HFCs will continue to be a key contributor toward energy efficiency goals in the near- to medium- term**. Any future transitions to new technologies need to take into account the time, costs, and other resources associated with an industry conversion that would need to occur without compromising current energy efficiency performance.

1 "Promoting Energy Efficiency Investments — Case Studies in the Residential Sector", IEA (International Energy Agency), 2008. ISBN 978-92-64-04214-8: 15.

2 "Innovations for Greenhouse Gas Reductions – A life cycle quantification of carbon abatement solutions enabled by the chemical industry", ICCA (International Council of Chemical Associations). 2009. Available at: www.icca-chem.org/ICCADocs/ICCA__A4__LR.pdf.

3 "The Carbon Productivity Challenge: Curbing climate change and sustaining economic growth", McKinsey Global Institute, 2008. Available at: www.mckinsey.com/locations/swiss/news__publications/pdf/mgi__carbon__productivity__challenge__report.pdf

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The Alliance is an industry coalition that was organized in 1980 to address the issue of stratospheric ozone depletion. It is presently composed of about 100 manufacturers and businesses which rely on HCFCs and HFCs.

Today, the Alliance is a leading industry voice that coordinates industry participation in the development of international and U.S. government policies regarding ozone protection and climate change.