

Commitment to Sustainability and R&D Leads to Breakthrough Solution for Midea

“Midea is a global leader in the manufacture of energy-efficient appliances. Our planned use of a blend of HFC-245fa and Honeywell Solstice® LBA will provide us with the lowest-cost route to meet current and future energy standards.”

Sangjo Suk - Vice President, Refrigerator Division, Midea

The Challenge:

Midea is facing the challenge of meeting increasing energy efficiency requirements and environmental regulations globally.

The Solution:

Midea has developed a blended foam system using cyclopentane, HFC-245fa and Solstice® Liquid Blowing Agent, and is confident this blend will meet the changing global energy standards and regulations on GWP.

Midea Faced New Challenges With Each Generation of Blowing Agent Technology

There are many factors that impact a refrigerator’s efficiency and environmental footprint, but one of the most critical is having the best insulation performance so that OEMs can meet increasingly stringent energy standards while maintaining or reducing the cost of doing so. When it comes to the foam insulation’s thermal performance (the energy efficiency of the finished refrigerator / freezer), the key component is the foam blowing agent.



Ruling Out VIPs and Changes to Compressors

When Midea was exploring the factors needed to balance cost effectiveness and energy efficiency, they first tried optimizing the compressor, to improve the efficiency of the fixed frequency compressor (i.e., improve capacity), or changing to an inverter compressor, which could contribute 10-15 percent improvement in energy efficiency. However, the cost increase was around 100-150RMB per unit.

Then they tried installing vacuum insulated panels (VIPs), which can also provide a 10-15 percent energy improvement. However, the added cost was 300RMB per unit. Also, the fiberglass in today’s VIPs cannot readily be recycled and must be extracted from the unit before incineration adding an additional environmental consideration to their manufacture if proper disposal cannot be assured.

Environmental Drivers: Midea Moves to Mitigate Ozone Depletion and Global Warming

When it became apparent that CFCs depleted the ozone layer, the foam blowing agent industry started work on replacement technology.

When HCFC-141b (the 2nd generation of foam blowing agents) was introduced, Midea developed a polyol system with high degree of functionality to improve the foam strength in their refrigerators. However, when Midea switched to ABS liners, they experienced some compatibility issues and needed to further innovate to work successfully with the new formulation.

Then, due to 141b's ozone depletion potential, Midea's next move was to develop a cyclopentane (Cp) system. Cp has a higher boiling point so the flowability was not as good as with HCFCs, but Midea developed a high functionality polyol with lower viscosity and silicone oil with better flowability.

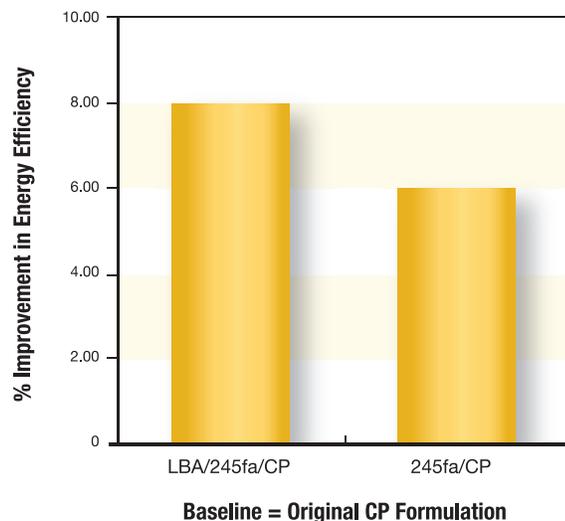
Another disadvantage of the Cp system is lower insulation performance. Although the GWP of Cp is lower than 141b, it negatively impacts the total GWP due to higher energy consumption over the life of the product.

Midea's New Blended System Includes Solstice Liquid Blowing Agent

Since Midea sells appliances in more than 200 countries, they knew they needed to consider global energy standards. They liked the efficiency of HFC-245fa, but its GWP is 858. HFCs are also coming under regulatory pressure in many countries around the world and are being targeted for phaseout. With Solstice LBA, Midea saw not only an improvement in efficiency over 245fa, but also a product with a GWP of only one, helping them prepare for emerging HFC regulations.

Midea finally explored improvements to the foaming system, which they had been studying for several years. When they switched from straight Cp to a Cp / 245fa blended system, the unit cost increased only slightly but they saw significant energy efficiency improvements of 5-7%. Then, by adding Solstice LBA, they were able to improve the insulation performance even further. Midea's new Cp / 245fa / Solstice LBA blend system is now in mass production, and Midea is confident that their refrigerators will meet the changing global energy standards and regulations on GWP.

ENERGY EFFICIENCY IMPROVEMENT OF BLENDED BLOWING AGENT SOLUTIONS



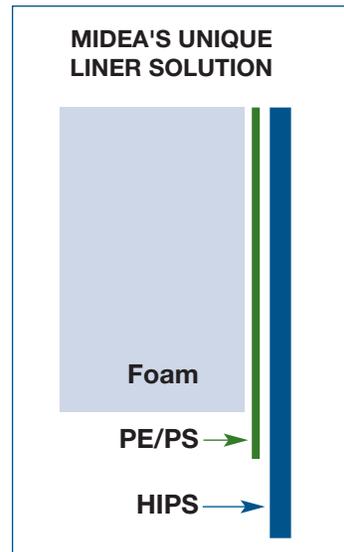
Identical refrigerator models using different foam blowing agent systems were compared in recent production trials at Midea. The test showed that, compared to a pure Cp solution, when 245fa was blended with Cp, the energy efficiency of the finished unit improved by 5-7%. When Solstice LBA was blended with Cp and 245fa, the energy efficiency improved by 8%.

Unique Liner Solution

With the new foam blowing agent system determined, Midea then spent more than a year working with their plastic supplier to develop an innovative new polyethylene and HIPS alloy material with a polyethylene/polystyrene barrier layer to offer the performance Midea was looking for with the new system. Liners were free of blisters, cracks or any visual degradation, and provided the glossy look that the market requires, comparable to ABS.

With this unique three-layer HIPS solution, Midea achieved:

- Optimized cost, performance and product quality/gloss
- Excellent compatibility with the foam containing HFC-245fa and Solstice LBA
- Improved gloss compared with ABS



What's Next for Midea?

In late 2013, Midea started researching a pure Solstice LBA system. The cost increase was significantly lower than changing to inverter compressors or VIPs, with a corresponding energy efficiency improvement of 10-12% over Cp, mainly because of the excellent insulation performance at low temperatures. Meanwhile, the Solstice LBA system has:

- Ultra-low GWP of 1, compared to a GWP of 858 for 245fa
- Better flowability than Cp

Midea also has a visible commitment to sustainability. They are continuing to work with Honeywell under a grant from the U.S. Trade and Development Agency (USTDA) to further the development of Solstice LBA-based solutions for China and beyond.

At a recent supplier event, Mr. Wang, president of Midea's Refrigerator business unit, noted their commitment to sustainability and the environment, and said, "The adoption of Solstice LBA fits perfectly with that commitment."

In the next three years, Midea's strategic vision is to become 'the leader of the Chinese home appliance industry, and in the top three global white goods manufacturers. Midea continues to deepen transformation, improve management quality, focus on customer orientation, technology innovation, quality improvement and lean management to achieve the leading products and advanced strategy needed to support the company growth.

About Midea

Midea is a leading Chinese appliance manufacturer with total sales of \$19.7B in 2013, including \$7.4B overseas sales revenue. Midea's products are sold in more than 200 countries.



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