In 1999 Shaw Industries, a Berkshire Hathaway company, pioneered fully recyclable PVC-free carpet tiles with a revolutionary new backing material called EcoWorx.® Within the highly competitive forces that are typically present in a mature and consolidating industry, EcoWorx raised the bar for durable goods manufacturers of all kinds. Supplier collaboration facilitated the technical innovations that allowed Shaw to produce carpet that was not only recyclable, but also maintained the properties of virgin material throughout the recycling process at a reduced cost. Reduced input costs were further boosted by manufacturing, transportation and handling savings resulting from a 40% reduction in the weight of the end product. Awarded a Presidential Green Chemistry Challenge Award in 2003, Shaw was recognized in its industry as an innovator.

History of Shaw and the Evolution of Technology

Founded in the boom years just after World War II, Shaw started out as a dye company and grew rapidly through the acquisition of other firms. Shaw Industries was publicly traded on the New York Stock Exchange until 2001, when it was purchased by Warren Buffet’s Berkshire Hathaway Inc. Along with its competitors in the floor covering markets, Shaw had seen many adaptations to technology and buyer preference changes.

After World War II technological advances, consumer tastes, and materials shortages transformed the carpeting landscape. Carpets that had been traditionally woolen were eclipsed by man-made fibers: By the 1960s, DuPont and Chemstrand’s nylon and acrylic materials supplied most of the carpeting industry. In 2004, nylon, polypropylene, and polyester accounted for more than 99% of the fibers used in carpet manufacturing, with wool constituting less than 0.7% of the total.

For many years the top five players in the floor covering industry were DuPont, Shaw Industries, Milliken & Company, Mohawk Industries, and Burlington Industries. By 2000, however, DuPont, primarily a chemical-maker, was restructuring its businesses and exiting the textiles markets. Burlington was also restructuring as a result of bankruptcy proceedings. Vertical integration and consolidation in the industry followed, resulting in more than 90,000 textile job losses and about 150 plant closings in the United States. By 2005 growth had rebounded, but competition was fierce, and buyers would not tolerate higher prices or performance losses. In 2007 the global market for carpeting was expected to grow to $70 billion, with a predicted growth rate in excess of 17% for the rugs and carpet markets combined.

Shaw Industries of Dalton, Georgia, was the world’s largest carpet manufacturer in 2006. With popular carpet brand names including Cabin Craft,® Queen,® Designweave,® Philadelphia,® and ShawMark,® Shaw sold
residential products to distributors and retailers and commercial products directly through Shaw Contract Flooring. The company’s primary market was in woven and tufted broadloom (commonly called “allover” or “wall-to-wall”) rolled carpet. In addition to broadloom carpet, the company also sold carpet tile, laminate, ceramic tile, and hardwood flooring.

Though ubiquitous in our homes and offices, carpeting is not the sort of thing most people probably think of as an environmental concern — let alone an opportunity. But carpeting is frequently replaced, and because traditionally it has not been recyclable, 95% of carpet ends up in a landfill. In 2002, carpeting contributed 4.6 billion pounds of waste into U.S. landfills.1

### Carpet Tiles: The Focus for Innovation

Carpet tiles, an alternative to broadloom, are often found in commercial applications such as offices, hospitals, and universities. Introduced more than 30 years ago, carpet tiles enable low-cost replacement of stained, damaged, or high-wear sections and easy access to subfloor utility connections. Carpet tile’s higher selling price and rapid market growth made it a logical focus for exploring alternative system designs.

Carpet tile is composed of a face fiber and a backing. For the face there are only two materials viable in commercial carpet applications: either Nylon-6 or Nylon-6.6 fiber. A tile’s backing provides the tile’s mechanical properties and its adhesive stability and has historically contained PVC. In a variety of applications, from athletic shoe soles to household plumbing, PVC has come under suspicion, due to the potential of the plasticizer to migrate from the material, causing health problems and product failure. Banned in certain markets worldwide and restricted in its applications, PVC is a known hazard to human health in its production process and at end of life.

It is important to note that carpet tiles, by nature of their mechanical design, have more stringent backing adhesion performance specifications than broadloom. Backing provides functions that are subject to engineering specifications, such as compatibility with floor adhesives, dimensional stability, and securing the face fibers in place. With innovative chemistry, and cooperation from supplier Dow Chemical, Shaw developed EcoWorx, a carpet backing that was free of both PVC and antimony trioxide. Uncontaminated with these toxicants, EcoWorx carpet backing could be recycled. This backing was coupled with a face fiber, EcoSolution Q Nylon-6, that could and would be recycled as a technical nutrient (a substance that can be recovered and reused) through a recovery agreement with Honeywell’s Arnprior depolymerization facility in Canada.

Though recycling in common parlance is a fairly straightforward description of Shaw’s process, Shaw went one step further. A distinction that is important here is that things that a consumer normally recycles, such as white paper or plastic bottles are actually downcycled. Due to the
design of the products themselves, impurities introduced during use and the actual recycling processes, these fibers are usually contaminated or configured in such a way as to prevent them from being recombined and put to the same original purpose without a loss in quality. A case in point: The naked eye can usually spot the flecks in postconsumer recycled paper. Not so with Shaw’s carpet tiles, which are not only recycled but actually upcycled: Nylon recovered after recycling a carpet tile demonstrates no loss of performance or quality, can be made into carpet tile of equal quality, and costs the same or less than virgin material.

Largely because EcoWorx backing is recyclable it provides cost savings on several fronts. EcoWorx backing reduces the weight of carpet tile by 40%, adding efficiencies all along the life cycle — especially in production, transportation and handling. That tile design also facilitates immediate recovery and use of the inherent technical nutrients, thereby dramatically reducing waste during the processing phases. EcoWorx tiles also use a minimum number of raw materials, none of which loses value, because all of them can be continuously disassembled and remanufactured. Essentially EcoWorx tile remains a raw material indefinitely.

**Why Innovation in Flooring?**

For carpet industry executives, concern for the natural environment has been top of mind for more than a decade. According to architect and environmentalist Bill McDonough, “The carpet industry is the battlefield where the war for sustainability is being waged.” The concern is not only over disposal, but also concerns the chemicals that go into carpet manufacturing and even the off-gassing that occurs as our shoes abrade away the fibers under our feet. There are essentially three drivers for the environmental pressure in the carpet industry: Ray Anderson and Interface, federal government purchasing guidelines, and green building standards.

In 1994 Ray Anderson of Interface volunteered his carpet company for the ambitious and very public pursuit of becoming a sustainable corporation. His personal epiphany, in turn, required competitive response from every major player in this mature industry. A few years later Presidential Executive Order 13101 (and others) fueled the demand for “environmentally preferable products” in government. And in 2000, recognizing that buildings account for 30% of raw materials use and 30% of waste output (136 million tons annually) in the United States, the Leadership in Environmental and Energy Design (LEED) Green Building Rating System™ was developed, and grew quickly into an internationally recognized certification program for environmentally sensitive design. Carpet selection is an integral element of LEED certification via materials requirements such as “Minimum Recycled Content” and the “Low-emitting Adhesives and Carpeting” requirements.

These proenvironmental pressures culminated in industrywide cooperation
and agreement. In January 2002, carpet and fiber manufacturers, along with the Carpet and Rug Institute (the industry trade association), state governments, nongovernmental organizations, and the U.S. EPA, signed the National Carpet Recycling Agreement. This voluntary agreement established a 10-year schedule to boost recycling and reuse of postconsumer carpet and reduce the amount of waste carpet going to landfills. The agreement set a national goal of diverting 40% of end-of-life carpet away from landfill disposal by 2012.  

Also in 2002, the industry created the Carpet America Recovery Effort (CARE), a partnership of industry leaders designed to enhance the collection infrastructure for postconsumer carpet and report on progress in the carpet industry toward meeting the national goals defined in the National Carpet Recycling Agreement.

Spurred on by Interface’s public commitment to sustainability, Shaw began its research into environmentally sustainable carpet technologies in the mid-1990s. Shaw’s objective was to create an infinitely recyclable carpet tile, one that could be entirely recycled with no loss in quality from one lifecycle to the next. In 1997 a Shaw researcher remembered reading about a particular method of processing polyolefin resins which produced flexible, recyclable polymers. Polyolefins were an intriguing material for Shaw to explore as carpet backing, since their purchase of Amoco polypropolene (a type of polyolefin) extrusion facilities gave them 300 million pounds of fiber extrusion capacity. After nearly $1 million invested in research and development, the tests suggested that polyolefins could be melted and separated from Nylon-6, and therefore successfully recycled into like-new materials. Shaw created a pilot line of carpet tile set on a polyolefin backing that exceeded the performance of traditional PVC backings. EcoWorx production capacity was built and the material became standard backing for all new Shaw carpet tiles.

In the broadest sense EcoWorx came about due to competitive pressure to innovate and solve health-related problems. Vigorous R&D and the collaboration of two key suppliers, Dow Chemical and Honeywell/BASF, were crucial to the development and implementation of the new EcoWorx manufacturing and upcycling process. Industrywide agreements and associations fostered the development of this product, and LEED green building standards and government purchasing programs pulled the innovation through to market success.

