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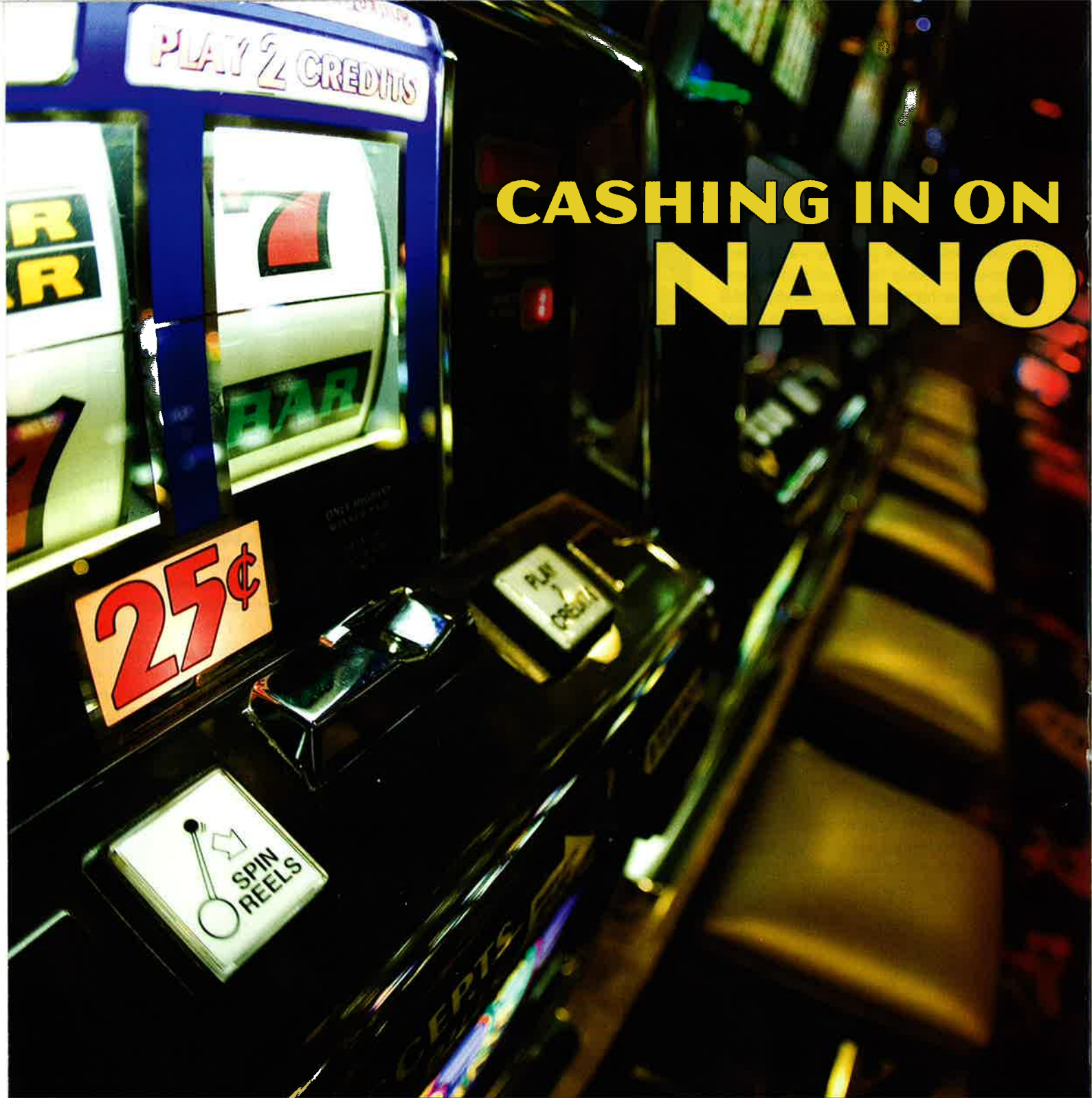
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# CASHING IN ON NANO

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# TECHNOLOGY

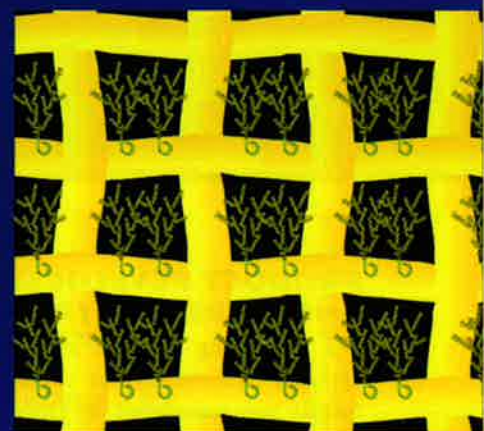
## Small-scale treatment, large-scale benefits

by Marty Gurian, Designtex

**E**xtrême performance upholstery is defined as highly durable upholstery that demonstrates excellent stain resistance and easy cleanability. Introduced into the contract fabric markets in the early 1990s, it was the result of developments in solution-dyed upholstery fibers, an expanding range of stain resistant finishes and fluid barriers, and improved vinyl, urethane and composite upholsteries. The demand for extreme performance upholstery continues to increase significantly, especially for demanding applications in health care facilities, sporting arenas, airports, educational facilities, hotels, restaurants, casinos and cruise ships. Many corporate end users are now specifying extreme performance upholstery instead of traditional standard contract types.

### **NANOTECHNOLOGY**

Notable among the popular high-performance upholstery finishes are those based on nanotechnology, introduced earlier this decade. The first type of nanotechnology to be applied successfully to interior textiles was based on the use of nanowhiskers, which could be permanently attached to textiles to provide enhanced, durable resistance to spills and stains. The hooks of the nanowhiskers are bonded to fibers, unlike topical finishes that can be worn down, cleaned off or otherwise chemically compromised. Textile aesthetics, such as color and hand, are not affected by this bonding process.



The hooks of nanowhiskers ( $1 \times 10^{-9}\text{m}$ ) are bonded to fibers, rather than finishes that are topically applied and can be worn down, cleaned off or otherwise chemically compromised.

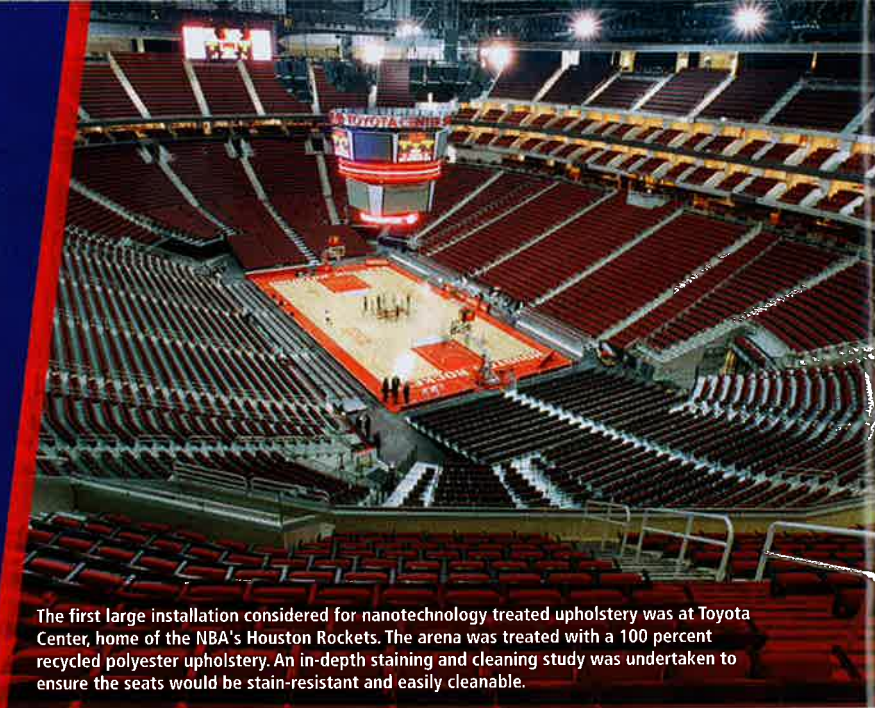
## WHAT IS IT?

High performance upholstery finishes based on nanotechnology, introduced earlier this decade, must meet three criteria established by the National Nanotechnology Initiative:

- The technology is developed at the nanoscale, or between 1 and 100 nanometers. A nanometer is equivalent to one billionth of a meter, which is the width of 3 to 5 atoms.
- The technology involves the manipulation and ordered assembly of components, thus creating unique properties. Ordered assembly provides a more durable bond and a more efficient use of chemistry, which allows the fabric to maintain its natural look and feel.
- The size and ordered assembly of the technology results in unique properties, such as protection from spills and stains.

## PRODUCT DEVELOPMENT AND MARKET INTRODUCTION

The pioneering research and development of applying nanowhiskers to commercial interior textiles was introduced by Designtex in 2001 with Nano-Tex, the developers of the technology. Engineered clusters of molecules with stain repelling properties were permanently attached to 100-percent recycled polyester panel and upholstery fabrics, making for enhanced stain resistance and easy cleanability. Early product development efforts created interior textiles that could be cleaned with both water- and solvent-based cleaning agents, and after treating with Nano-Tex, a wide range of stains could be successfully cleaned with either water- or solvent-based cleaning agents. A diverse range of germicides could be used repeatedly and safely to disinfect the treated fabric without losing stain resistance. Diluted bleach (4:1) could be satisfactorily used on 100-percent solution-dyed fiber. Additionally, a high level of stain resistance and easy cleanability was observed for four baseline stains that Designtex used to evaluate extreme performance upholstery after a seven day set: coffee, Italian salad dressing, yellow mustard and Betadine (diluted iodine).



The first large installation considered for nanotechnology treated upholstery was at Toyota Center, home of the NBA's Houston Rockets. The arena was treated with a 100 percent recycled polyester upholstery. An in-depth staining and cleaning study was undertaken to ensure the seats would be stain-resistant and easily cleanable.

## APPLICATIONS AND CLEANING

The first large installation that was considered for nanotechnology treated upholstery was at Toyota Center, home of the NBA's Houston Rockets. The Rockets' organization and the design firm involved in this large and challenging project wanted to be assured that the treated upholstery would resist the specific stains in this heavily used (200 events a year), multi-purpose facility and be easily cleaned, since there is often only a few hours between events. In 2002, an in-depth staining and cleaning study was done with laboratory assistance from the Association of Specialists in Cleaning and Restoration.

Most of the stains were easily removed by water-based cleaning agents, with a few oil-based stains requiring a mild solvent. An additional study was done to identify solvents that are effective in removing oil-based stains. Among 13 solvents explored, Fantastik All Purpose Cleaner was the most effective. As a result of these studies, 18,000 seats using nanotechnology treated upholstery were installed in the summer of 2003. Similar upholstery was installed in 2004 at FedExForum in Memphis and at Target Center in Minneapolis, and in 2005 at Quicken Loans Arena in Cleveland. Upon inspection of the arenas in Houston, Minneapolis and Cleveland in 2006, Designtex was pleased to find these heavily used arenas well maintained. Arena management especially appreciated the fast-drying feature of the nanotechnology finish.

In 2005, the initial Nano-Tex treated solution-dyed nylon upholstery fabrics were developed and introduced. They were of immediate and great interest for health care applications because of their durability, stain resistance and chemical resistance, as well as environmental features, like low VOCs and recyclability. A durability study evaluated the effectiveness of nanotechnology treated upholsteries after repeated treatment by popular disinfectants. Five different treated recycled polyester and solution-dyed fiber upholsteries were tested by nine different disinfectants, including three popular and CDC-recommended quaternary germicides, three popular and CDC-recommended phenol germicides, ammonia, hydrogen peroxide, and diluted bleach (used on solution-dyed fabric only).

The nanotechnology treated upholsteries were disinfected and rinsed five times respectively with each of the disinfectants. A control group included in the study was not disinfected. Both the disinfected samples and the control group were stained and cleaned with the four baseline stains and then compared. There was no difference in the appearance of the disinfected sample group and the non-disinfected control group, demonstrating the durability of the nanotechnology finish to repeated disinfection.

Additionally, nanotechnology treated upholsteries can be successfully laminated to popular fluid barriers such as Designtex's 2 mil. polyurethane S-1.5 fluid barrier or Applied Textile's antimony-free recyclable polyester Durablock fluid barrier.

## ENVIRONMENTAL FEATURES

Nanotechnology finishes have demonstrated low emittance of VOCs, so when applied to a fabric that has low VOCs the combined results can meet the most stringent air quality standards in the United States, such as California's Section 01350, the Collaborative for High Performance Schools (CHPS) standard for educational facilities and certain health care firms. Nano-Tex has been awarded a Basic Certification by MBDC in its Cradle to Cradle Certification program. Also, if an environmental design upholstery achieves a higher rating, then the rating will be maintained if treated with Nano-Tex, as has been the case for a number of Designtex environmental design upholsteries.

Nanotechnology stain resistant finishes provide durable stain resistance and easy cleanability, which has been tested using rigorous cleaning and disinfection lab testing, and confirmed by visits to sport arenas and health care facilities. Nanotechnology finishes also provide environmentally friendly options, especially for some sustainable textiles to maintain their sustainability by minimizing the amount of chemicals needed for cleaning. Fewer chemicals can mean lower costs.

It is predicted that the use of nanotechnology in interior textiles will significantly grow as more finishes are developed to provide enhanced textile properties. This will be especially evident in nanotechnology types that demonstrate positive environmental features. As with the majority of technological advancements, the influx of nanotechnology in upholstery fabrics can mean lower cleaning costs for end users and new products for upholsterers to offer their customers. *uj*

*Marty Gurian is director of engineering resources and technical education for Designtex, a subsidiary of Steelcase Inc., in Secaucus, N.J.*

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Nanotechnology treated upholsteries can be successfully laminated to popular fluid barriers.



Lobby of Intermountain Medical Center, Salt Lake City, with a treated 100-percent recycled polyester upholstery. The demand for extreme performance upholstery continues to increase significantly, especially for demanding applications in markets such as health care.

## PUTTING STAINS TO THE TEST

The Toyota Center, home of the NBA's Houston Rockets, was the first large installation considered for nanotechnology treated upholstery. Prior to the installation, an in-depth staining and cleaning study was undertaken to make sure the seating would be stain resistant and easily cleaned.

Specific stains that were tested included:

**BEVERAGE STAINS** >> Coffee, orange juice, liquor, soda, beer, wine and fruit punch.

**FOOD STAINS** >> Nacho cheese, chili, spicy brown mustard, melted chocolate, honey mustard, chocolate syrup, hot caramel, yellow mustard, ketchup, Caesar salad dressing, relish/pickle juice, Italian salad dressing, salsa, barbecue sauce, tomato juice, cotton candy, Italian ice and gum.

**OTHER STAINS** >> Paint, blood, urine, varnish, lacquer, mud and Silly String (used by the Rockets' mascot).