

Synthetic Grass

March 2, 2009 Volume 87, Number 09 Web Exclusive **What's That Stuff?**
Carpet's cousin is rooted in relatively simple chemistry

Linda Wang

IT'S NO COINCIDENCE that a majority of the synthetic grass in the U.S. is produced in a

town some call "the carpet capital of the world," otherwise known as Dalton, Ga. The first synthetic grass was, in fact, woven on a traditional carpet loom.

The chemistry for producing synthetic grass is straightforward, like that of its floor-covering cousin. It begins with a polymer—either nylon, polyethylene, or polypropylene—which is melted at a high temperature, mixed with pigments and ultraviolet stabilizers to protect it from the sun's rays, and then extruded into thin ribbons of grasslike dimensions.

The type of polymer used depends on the application as well as cost considerations. Polypropylene is the cheapest option. Nylon offers more strength and resiliency than polyethylene and polypropylene, but it is the most expensive. Nylon also has a higher melting point than polyethylene and polypropylene, which makes the manufacturing process more difficult.

After the ribbons are formed, they are tufted, like carpet yarns, into a fabric backing, such as a woven polypropylene, and then attached with an adhesive such as polyurethane. During installation, some contractors place a foam padding underneath the backing to provide cushioning.

The idea for synthetic grass was first proposed in a 1961 report about urban childhood by the Ford Foundation, which proposed ways to give city kids outdoor play areas even though their schools lacked green space. According to the **AstroTurf** website, the Ford report proposed the invention of "a material that looks like grass and acts like grass, a turf-like substance on which a ball will bounce and a child will not." **Monsanto** engineers Robert T. Wright and James M. Faria took up the challenge, producing the first synthetic grass, which the company initially named ChemGrass, Wright tells C&EN.

The first installation of synthetic grass went into a field house at a school in Providence, R.I. Word spread about the new technology, reaching Roy M. Hofheinz, mastermind of the Houston Astrodome. At the time, the indoor Astrodome had been suffering from a severe case of dead grass. Hofheinz signed a contract for the first large-scale installation of ChemGrass, which was renamed AstroTurf.

Wright says the original AstroTurf consisted of nylon 6,6 mixed with cadmium yellow and phthalocyanine blue, which combined to form a green color. Ed Milner, Wright's colleague and later his supervisor at Monsanto, adds that the grass was woven, piece by painstaking piece, on a traditional carpet loom.

A May 29, 1966, *New York Times* article called the new infield a "triumph of chemistry." But the original AstroTurf was essentially a green carpet. "You would never have fooled a goat into eating it," Wright says. Cleaning required a simple vacuum, he adds.

Cushioning underneath the earliest synthetic grass installations was primarily polyvinyl chloride foam, but it provided little protection for players. The late 1990s saw the development of a crumb rubber infill, sometimes combined with sand. After the fake grass is installed onto a field, infill is mixed into the grass to keep the individual blades from falling over and to give the surface some bounce.

The new cushioning gives rise to a potential problem. The rubber in the infill comes from recycled tires and may leach harmful chemicals into the soil, says Junfeng (Jim) Zhang, a professor of environmental and occupational health at the [University of Medicine & Dentistry of New Jersey](#). "We really do not know much about the health risks," of synthetic grass, he adds.

LAST AUGUST, Zhang and his colleagues published a paper on a small-scale study showing that samples of crumb rubber contained concentrations of polycyclic aromatic hydrocarbons and several metals that were higher than soil limits set by the [New York State Department of Environmental Conservation](#) (*J. Expo. Sci. Environ. Epidemiol.*, **2008**, *18*, 600). Zhang says more studies are needed to determine the safety and potential health risks of these infill systems. Exposure to lead chromate commonly used in the pigments of artificial grass is another issue that needs to be studied, Zhang says.

Rick Doyle, president of the [Synthetic Turf Council](#), cautions against drawing conclusions on the basis of limited scientific data. The synthetic turf industry, he says, is committed to reducing the use of lead chromate in artificial turf and is working on alternative infill systems that do not contain crumb rubber.

For example, rubber infill is being replaced in some artificial turf by a layer of crimped nylon fibers packed like tiny springs, says Lou Ziebold, general manager of AstroTurf and [SynLawn](#), both of which are owned by Dalton-based [Textile Management Associates](#). The crushed fibers provide cushioning and bounce and are dyed light brown to mimic dead grass in an effort to make the product look more true to nature. Ziebold says his companies are also incorporating into their products antimicrobial coatings to increase player safety and soy-based polyurethanes to reduce the materials' carbon footprint.

As for the original 1960s-era AstroTurf, Wright says he brought home some of the scraps that didn't get used in the Astrodome and had it installed not on the outside, but on the inside of his home at the time—as wall-to-wall carpet.

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