FOCUS ON:

Polymer Science

Photo: TenCate

Layered protective fabrics offer optimum protection for fire fighters without sacrificing comfort

When it comes to innovation in polymer science, Dutch companies, universities and knowledge institutes work closely together, with assistance from the government. Centers such as DPI (Dutch Polymer Institute), M2i (the Materials Innovation Institute), and the BioMedical Materials (BMM) program provide coordination and support.

Accelerating polymer developments

Notable polymers developed by the Dutch plastics industry as far back as the 1970s are Twaron® and Dyneema® polymer fibers. Twaron is a para-aramid noted for its strength and heat-resistance. A small sampling of its applications includes flame-resistant clothing, sporting goods, textiles, and bulletproof vests. Dyneema is an ultra high molecular weight polyethylene widely used in ballistic protection, defense applications, and increasingly, medical devices.

The establishment of DPI ten years ago greatly accelerated polymer developments. DPI aggressively promotes closer collaboration among companies, knowledge institutes, and government. As a result, many new polymer projects are underway.

DPI's Value Center started up in September of 2007 to reinforce cooperation with smaller and emerging companies. This center also added trade organizations and innovative financial service providers to the mix. Joint projects of small and large companies are now ongoing. The smaller companies get a chance to play a role in developing new products, while the large companies benefit from shorter development times and wider markets. International companies also take part in these projects.

Some examples of recent successful polymer developments include:

- Artificial grass for sports facilities that's virtually indistinguishable from real grass. It offers superior shock absorption and water drainage to ensure optimum physical protection for the athletes.
- Car finish polymer layers that can be repaired by heat treatment.
- A printer that uses polymers instead of ink and works in three dimensions. The technique looks promising for printing conductive polymers for electronic circuits.
- Perkalite® by AkzoNobel, a synthetic organic clay that acts as a flame retardant in applications such as wires and cables for construction. Perkalite also increases the strength of packaging materials and finds use in car tires.

Fostering collaboration

Collaboration backed by Dutch institutions such as DPI is a powerful success factor for the Dutch polymer sector. Two recent examples include Chemelot and the Cradle to Cradle (C2C) environmental initiative.

Chemelot consists of a 2000-acre

Photo: Hollandse Hoogte

Artificial grass based on TenCate fiber technology

industrial estate in the southern province of Limburg. It houses about 70 diverse companies that vary from basic to fine chemistry, from raw material producers to new product developers, and from start-ups to multinationals. Chemelot's Center for Open Chemical Innovation recently began operations. Its mission is to attract new, fast-growing companies to encourage entrepreneurship in the chemical and new materials sectors. Assistance will revolve around financing, support services, coaching and networking.

C2C, a polymers network begun in January 2009, promotes environmentally friendly manufacturing. Used materials feed back into the biological cycle or — with no loss of quality — into the technical cycle. Throughout their life cycle, the products release no harmful emissions and benefit the environment. The network will organize several meetings intended to exchange practical information and bring many companies together.

Biomedical research

Thirty years ago scientists hypothesized that they could use polymers to build tissue for the human body. This idea is now nearly a reality thanks to Dutch government funding amounting to €45 million. The money will promote research into biomedical materials in an initiative known as the BioMedical Materials (BMM) program, a public-private partnership between companies, universities and hospitals.

Research is ongoing on biomedical materials to repair and rebuild tissue that has been damaged by disease or trauma. A biomedical polymer implant can be used to grow new tissue, blood vessels, muscles or cartilage and maybe even entire organs. The polymer breaks down slowly as it is replaced by bodily material.

Some BMM R&D projects include:

- iValve — an artificial heart valve made from a material that causes the body to grow a new, healthy heart valve.
- SMARTCARE — strengthening the heart muscle by introducing new heart muscle cells and blood vessels.
- IDiDAS — a replacement for the intervertebral disc. The goal is to invent a gel-like polymer that's strong yet flexible and delicate as a solution for wear and tear of the spinal column.
- NANTICO — development of biomedical coatings for implants that reduce infectious reactions or organ rejection.

Perkalite

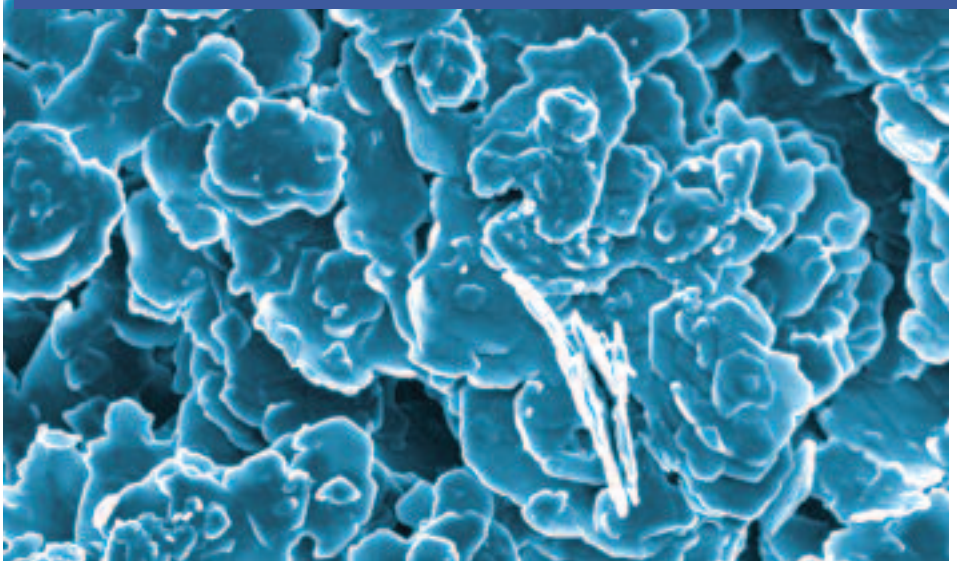

Photo: AkzoNobel Polymer Chemicals, Perkalite® by AkzoNobel

Miniaturization

The Foundation for Fundamental Research on Matter and M2i have funded seven research projects focusing on the properties of materials aimed at extensive miniaturization. The results will contribute to applications in nanotechnology.

Companies can become a member of M2i and contract out a particular assignment. M2i then searches for a suitable researcher and university. The government matches the amount that the company has paid and the university provides facilities and scientific staff free of charge. Member companies contract out R&D at low cost.

The results of a recent M2i study were published in the November 20, 2008 issue of the science journal *Nature*. The research uncovered a smart way of adding zinc to semi-conducting, indium phosphide nanowires (tubes on an atomic scale). This creates a crystal lattice with which heat can be directly converted into electricity.

M2i and other organizations in the Netherlands dealing with polymer science operate in a business environment that is international, open, and well connected to the outside world. Innovation and success are inevitable.