

ADVANCED MATERIALS

UNTIL NEEDED, THIS CORROSION PROTECTION STAYS PUT

Chromates are the most widely used and effective corrosion inhibitors, but are toxic and heavily regulated. Worse, they tend to leach out of their coatings, greatly reducing the amount of corrosion inhibitor available to protect metal while contaminating the environment.

With the help of MDA SBIR funding, TDA Research, Inc. (TDA; Wheat Ridge, CO), has developed a chromate-free corrosion-inhibiting additive that stays put in its coating until needed. The company says that an organic coating using its corrosion-inhibiting additive is a viable replacement for chromate-based coatings used to protect high-strength aluminum alloys.

For example, tests have proven that TDA's technology matches the performance of chromate corrosion inhibitors in protecting Al 2024 and Al 7075, which are primarily used in the military and commercial airframes. Cost isn't a factor because chromate-free coatings (\$2 to \$4 per pound) can be manufactured more cheaply than chromate coatings (\$3 to \$5 per pound), and there are no additional costs required for handling and disposal. TDA says that paint is one of the biggest commercial markets for its technology, and the company has been working with Sherwin Williams, the largest U.S. paint supplier, to bring the technology to market.

In addition to airframes, other potential markets include window frames and gas pipelines. TDA says that in humid areas of the United States, the windows of homes are made with extruded aluminum. However, if the coating is scratched, corrosion can quickly appear. TDA's technology would greatly extend the service life of these frames. TDA believes an extension of the technology also could be used in protective coatings for gas pipelines. Moisture tends to

collect and cause bacteria to build up near pipe junctions, leading to microbial-induced corrosion. Corroding gas pipelines leak and, in some instances, explode. TDA's technology could make an excellent antimicrobial, antifungal coating.

To make the additive, TDA purchases agglomerated metal oxyhydroxide from a bulk material supplier. The metal oxyhydroxide is then chemically treated to modify the surface of the particles, reduce the particle sizes down to 20 to 70 nanometers, and anchor the organic corrosion inhibitors on the outside surface of the particles. This anchoring capability is key because it protects the corrosion inhibitor from reacting with the polymer resin while the coating cures—a major drawback that has long prevented organic corrosion-inhibiting coatings from making an impact in protective organic coatings.

MDA awarded TDA a Phase I SBIR contract in 2002 to develop chromate-free corrosion-inhibiting coatings. The agency envisioned a pollution-free product that could protect the agency's coastal and remote island testing facilities located in Hawaii and the Kawajalein Atoll. While the first phase of the SBIR project was a success, the second phase was not picked up by MDA due to a shift in priority to Alaska-based facilities. However, TDA has continued work on the corrosion-inhibiting technology for the Navy, Army, and Air Force.

Corrosion is very costly and has a significant impact on the U.S. economy. According to a 2001 Federal Highway Administration report, the total direct cost of corrosion in 1998 was estimated at \$276 billion, or 3.1 percent of the U.S. gross domestic product. Sectors having the largest direct corrosion impact include drinking water and sewer systems, motor vehicles, and

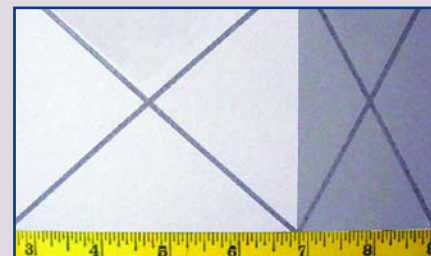
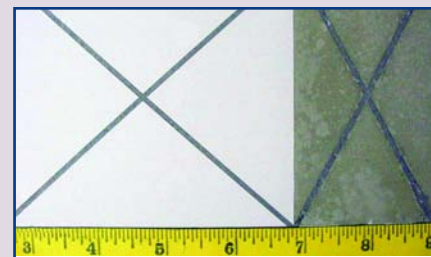
defense. Within the total cost of corrosion, a total of \$121 billion per year is spent on corrosion control methods and services.

While seeking licensees for its organic corrosion-inhibiting coating technology, TDA continues its research and development activities. One of its current explorations is extending the technology to other metals such as steel, iron, copper, magnesium, brass, and tin.

—P Hartary

CONTACT INFORMATION:

Ron Cook
TDA Research, Inc.
12345 W. 52nd Avenue
Wheat Ridge, CO 80033
Tel: (303) 940-2302
Fax: (303) 261-1130
E-mail: cookr1@tda.com
Web: www.tda.com



Sheet of worms. The telltale sign of filiform corrosion, which can build up under chromate coatings, is corrosion worms (top right). TDA's chromate-free corrosion-inhibiting material (bottom right) can outperform chromate coatings in filiform tests.