

Challenging Environment for Marine Coatings



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Marine coatings must provide protection and performance under extremely harsh conditions. Today, marine coatings producers are finding that the current regulatory environment has made the development and introduction of coatings that meet the needs of shipbuilders and operators as challenging as the physical environment in which their products must perform. Several other factors are also strongly affecting the marine coatings market. The industry has responded by investing heavily in research and development efforts designed to create new technologies that will enable marine coatings to meet future regulatory requirements and provide the performance demanded by the marine industry.

The U.S. marine coatings market is estimated by The Freedonia Group to be worth approximately \$450 million in 2004, based on volume of 22 million gallons. The Cleveland, OH-based market re-

search firm pegs the growth rate for marine coatings in the U.S. at a modest 3% per year.

The growth of the marine coatings market is occurring in the face of tremendous regulatory pressures. Restrictions on antifoulant compounds have been most significant. In 2003, a ban on the application of organotins took effect and by 2008 ships shall not bear organotins on their hulls or they will be required to have a barrier coat that prevents leaching of organotins from the underlying noncompliant coating. The European Union through its Biocidal Products Directive is seeking to establish stricter regulations on other antifoulants as well. The use of copper as a marine antifouling agent is currently under review in many nations. However, there is not a reliable replacement, and its use on large vessels is not expected to be impacted for at least the next five to seven years. The use of copper on

recreational boats may be nearing an end, though, because concentrations of the metal can get high in small enclosed harbors. In both the U.S. and Europe, continued reduction of allowable limits for volatile organic compounds (VOCs) has also impacted the marine coatings industry.

The regulatory climate has significant implications for the future of the marine coatings industry. "These regulations require a large investment in R&D and follow up," says Miles Buckhurst, product manager for Jotun Coatings. "From a global perspective, the ban on organotin-containing antifouling coatings has significantly impacted the technology/development as it pertains to underwater hull coatings and systems," says Eric Bosanac, director of Marine & Offshore Coatings with The Sherwin-Williams Company. In the U.S., the current NESHAP (National Emissions Standards for Hazardous Air Pollutants) regulation is moving the marine coatings market to higher volume solids, low-VOC solutions. "Future regulations will continue to focus on the use of higher volume solids products and environmentally friendly underwater hull solutions," Mr. Bosanac adds.

Resistance to change has been a factor in dealing with the changing regulatory environment. "One of the major impacts is just overcoming the need to change antifouling actives," says Andy Jacobson, technical fellow with The Rohm and Haas Company. "It is not only the ship owners who had to overcome the resistance to change, earlier the paint manufacturers had to overcome the same resistance. The marine coatings manufacturers and the suppliers of antifouling actives have had to ensure that the new antifouling actives will provide the necessary efficaciousness as tributyl tin (TBT) but also be environmentally acceptable." Dr. Jacobson also notes that most paint manufacturers have had to develop new and appropriate paint formulations for the TBT replacements, and as a result, the shipping industry has had to develop a level of confidence that these new coatings will be a complementary replacement for those containing TBT.

Coatings producers must also be constantly aware of local, national, and international regulatory issues. Mr. Buckhurst points out that some raw materials may be banned in certain areas of the world while they are still in wide use in others, and producers should be prepared for additional bans on these types of substances.

Companies must be future-oriented under these types of market conditions. "While no one has a crystal ball, the smart paint manufacturer, and anti-foulant suppliers as well, should be looking into the future so that they will not have to reformulate anytime in the near future," says Dr. Jacobson. Most expect that more stringent regulations will be implemented throughout the world in the coming years. "It would be wise for companies to perform high quality studies using the best current technology now so that the studies can satisfy future regulatory requirements. There is no benefit to the manufacturers, the government regulators, or the public to continually repeat studies," he adds.

Most producers have been fully aware of the regulatory climate and have been working diligently to develop products that will be in compliance. "We believe that the industry as a whole is aware of and ready for the foreseeable regulations," notes Mr. Buckhurst. "The question is—is the customer ready to take the brunt of the cost? These modern coatings are alternatives to more economic solutions. The raw materials are expensive and not necessarily commonly used. However, on the bright side, many will have economic benefits with longer life in use and therefore a reduced life cycle cost," he adds. The industry will also need to educate end users, applicators, and owners in order to convince them to adopt new coating products and systems, according to Mr. Bosanac. In order to do so, coatings manufacturers need to develop supporting data to demonstrate that these new products meet the performance expectations demanded by their customers.

In addition to these major regulatory issues, coatings manufacturers must deal with other challenges within the marine industry. Rising energy and raw material costs have negatively impacted coatings manufacturers in general. At the same time, according to Mr. Buckhurst, freight rates are high and therefore the level of dry-dockings has been down, at least for the first half of 2004. Projects such as ballast tank refurbishment have been delayed so that vessels can remain in service longer.

"The demands for underway time and minimal dry-docking for maintenance and repair are requiring vessel operators and owners to utilize their equipment more efficiently," says Mr. Bosanac. "With increased concerns regarding terrorism, ship operators want and demand more time in trade routes and less downtime. With this



Photo courtesy of Hempel.

has come the increased size of cargo vessels along with increased speed to move more commodities in a more expedient manner. Here again, this is driving coatings manufacturers to search for products that are higher in performance and assist in keeping the vessel underway for longer periods of time," he continues.

Other changes have been just as significant. According to Mr. Buckhurst, newbuilding and maintenance activities now require specialized products with different properties for each application. Open air sandblasting is also under pressure from regulations. "New coatings must be developed that are surface tolerant and do not require abrasive grit sandblasting as surface preparation for high performance," notes Tom Brown, director of marine marketing for Ameron International. "These new products will require more high tech chemistries in order for the coatings to perform in aggressive marine environments. It's all about reducing application costs," he adds.

Extending the time between coatings applications, which currently is about five years, is also a goal for the industry. The U.S. Navy has a goal of obtaining 12 years between paintings. According to Dr. Jacobson, both industry and a number of governments (with the U.S. Navy probably the largest supporter) have research programs underway to lengthen the time between coating applications. "These research programs involve new coatings technology, improvements of existing coatings, and involve increasing the in-service life of coatings and reducing the amount of active ingredient entering the environment," he explains.

The global nature of the business has also impacted the industry. "The current marine coatings market continues to see joint ventures and teaming arrangements in order to supply customer needs in strategic locations," notes Mr. Bosanac. "Global product availability and technical support have become increasingly more important to the customer." There is also a general trend away from Europe, and to a lesser extent the U.S., towards Asia and especially China, according to Mr. Buckhurst. "Newbuilding activities have been moving towards Korea and China while remaining strong in Japan, and this trend is expected to continue. Owners

based in Southeast Asia are strengthening their businesses, and major growth in China will likely lead Chinese operators to become a major force in the worldwide market," he explains.

He adds that products that are more multi-functional or have greater capabilities for shipboard environments are desired. Dr. Jacobson points to the development of low surface energy/foul release coatings as having a potential to significantly impact the industry in the future. "The development of a durable and effective low surface energy coating could be applicable to a significant number of the commercial vessels as well as recreational boats," he explains.

Despite the challenging business climate, one fact remains: Coatings manufacturers must understand the needs of their customers and develop products that fulfill those requirements. "Productivity, process efficiency, minimized build cost, and a safe working environment are key requirements of today's ship builders," says Jim Brown, marketing operations manager with International Paint Ltd., an Akzo Nobel company. He further notes that "optimized performance, operating image, corrosion protection, cargo carrying flexibility, maximized fuel efficiency, and minimized lifetime operational costs are all critical requirements of the professional ship operator."

As marine coatings manufacturers grapple with the development and introduction of new coatings that meet ever-increasing environmental regulations, demand for high performance protection of marine vessels increases. Therefore, those companies that look to the future and invest in R&D efforts to develop high performance, regulatory-compliant coatings will be successful in this challenging marketplace. "Corrosion control and preservation of capital are becoming increasingly more prevalent within the world public domain and shipping disasters and environmental consequences are too high to have vessel managers and operators neglect maintenance or preservation methods," says Mr. Bosanac. "Thus, high performance coatings technology to the marine community will continue to evolve. With this will come an increasingly higher demand of services and support from marine coatings suppliers."



MARINE COATINGS — Supplier Roundup

• **Akzo Nobel** has already identified, removed, and replaced substances of concern in marine products, including red lead, zinc chromate, glycol ethers, and aromatic amines, according to Jim Brown. In addition, the company was the first major supplier to formally announce the cessation of manufacture and supply of TBT-containing antifoulant coatings. It has introduced two new chemistries to replace the older technology.

Intersleek 700 controls marine fouling without the use of biocides. Working on a foul release mechanism, fouling organisms are typically unable to attach or have difficulty settling onto the Intersleek surface. Those which do settle, normally only do so weakly and can usually be easily removed by self cleaning in service as the ship moves through the water. **Intersleek 700** is especially suitable for deep sea, high activity, scheduled ships such as container carriers that travel at 15-30 knots. **Interplate Zero** is a patented water-based, weldable, and overcoatable zinc silicate shop (preconstruction) primer with zero-VOC content. Unlike currently available water-based zinc silicate products which require specialized application equipment, **Interplate Zero** can be applied using standard airless spray.

Akzo Nobel recently opened a new 4 million state-of-the-art R&D laboratory at its International Paint facility at Felling in the United Kingdom. In addition to the new laboratory, the existing R&D building on the Felling site will be re-designed and

transformed into a new Technology Center. These new initiatives are part of an ongoing investment of over \$10 million into the company's research and development facilities around the world. A new laboratory was opened on Gooje Island in South Korea, and a major upgrade was carried out at the Newton Ferrers, Plymouth Marine Laboratory in the UK. Additional work has also been completed at the Asia Pacific Technical Center in Jurong Town, Singapore.

Recently International announced that it has received a contract to supply the U.S. Military Sealift Command (MSC) with product and service for 29 different MSC facilities in 12 global Navy zones plus 33 additional shipyards worldwide. An integral part of the contract is the provision of engineering support and quality assurance. Products selected for supply include high performance antifouling, anticorrosives, cosmetic finishes, and specialist deck coatings systems for ship stores and drydocking activity.

• **Ameron** offers a full line of high performance marine coatings, including well proven TBT-free antifouling technology. The company pioneered the use of polysiloxane coatings for marine environments. Recently Ameron introduced a high solids (87%), low-VOC (<150 gms per liter),

surface tolerant, user-friendly, and universal use general purpose epoxy coating. **Amercoat 240 Universal Epoxy** addresses the concerns of both applicators and end users and provides tremendous economies of scale with a fewer number of products being required for major new construction and refurbishment projects.

• **Corroscel's** low-VOC **Corroscel® Rust Converter** was the first effective water-based coating in the U.S. to gain acceptance for seagoing vessels and equipment. **Corroscel** meets all regulatory requirements, provides relief from sandblasting and hazardous waste removal for improved at-sea maintenance, safe worker exposure, and imparts an adherent durable substrate for intermediate and top coat systems by many other manufacturers. The company's **Crystal Lok®** concrete waterproofing treatment creates zero porosity, allows for very low-VOC treatment of concrete within vessels and onshore facilities, and offers ease of application. Because of its subsurface penetration, **Crystal Lok** is unaffected by surface abrasion from equipment, traffic, or by salt or chemical attack and freeze damage.

• **Hempel's** **Globic** marine coatings are fiber-containing antifouling based on synthetic rosin with co-



Akzo's new laboratory at its International Paint facility in the United Kingdom.

binders to control the self-polishing mechanism. Synthetic rosins are not sensitive to oxidation like natural gum rosin and also do not have the impurities or quality inconsistency that can be found with the natural antifoulants. The fibers eliminate the brittleness of the rosin and allow for a high binder and co-binder content. These coatings also provide a self-smoothing effect. Globic is available in four different polishing rates and can be specified for up to five years of service life on the entire underwater hull. Oceanic and Olympic are cost-effective, TBT-free, self-polishing, high-solids antifouling coatings that can be specified for up to three years of service life on flat bottoms or both vertical and flat bottoms, respectively.

Hempel also offers fouling release coatings based on silicone elastomers under the Hempasil name. These coatings cause marine organisms that try to settle on the surface of the vessel to detach through a combination of low surface tension, flexibility in the coating film, and water resistance.

Recently Hempel announced that it is reorganizing in order to change the company from a country-based, product-oriented organization into a client-focused, service-oriented "One Company" organization with better balance between and within the various business areas.

- **Jotun** introduced in 2000 its structured Innovation Process for product development. Directors of Jotun Coatings, together with lab and marketing personnel, are actively involved in focusing and refining concepts and product development. Since the program was implemented, 10 new products/concepts have been launched globally. Antifouling SeaQuantum is a range of self-smoothing and self-polishing lin free antifoulings. Based on silyl chemistry,

these products smoothen due to a chemical reaction with seawater and reduce the friction of the hull as the vessels trade, allow the ship to maintain speed, and reduce fuel consumption.

Jotacote Universal is a universal anticorrosive primer that provides fast re-coating times, offers excellent anti-abrasion properties, is compatible with most other coating types, and is designed for use all around the vessel at newbuilding. Balloxy HB Lumi is a ballast tank coating based on Balloxy HB Light, which has been a very successful product for Jotun. UV light is used to expose defects in the coating, aiding the correct application, and thereby extending the life of the coating project.

During 2004, Jotun has invested NOK 67 million, a significant increase over 2003. A number of production facilities have been upgraded and new paint factories in Indonesia and China are under construction. The company's paint factory in Vietnam is being expanded and a new paint factory in Dubai and a powder coating factory in Pakistan were opened in April, 2004.

- **Rohm and Haas Company** developed and sells the antifouling active, Sea-Nine™ 211 Antifouling Agent, which has received a Presidential Green Chemistry Challenge Award. This compound has a dramatically improved environmen-

toxic than the parent. Thus, the rapid biodegradation detoxifies the compound. The company is currently developing improved formulations of Sea-Nine 211 Antifouling Agent and completing the registration package that will meet global regulations including the European Biocidal Product Directive, according to Dr. Jacobson.

- **The Sherwin-Williams Co.** works with vessel managers or owners and suppliers of numerous consumable and sundry products as part of the Marine Triad. In doing so, expectations can be better met with coatings and products that meet the requirements of the customer. The company has introduced a line of rapid return to service products and also products that can be applied in one application and achieve performance as good as if not better than traditional two coat systems. Fast Clad ER for ballast tanks is a single coat (or multiple coat) edge retentive coating that can be walked on within four hours, and placed back in service within 24 hours.

From a topside perspective, Fast Clad Urethane and Fast Clad Direct-To-Metal Urethane are new polyaspartic chemistries that are high-build coatings with low VOCs that can replace traditional epoxy/anticorrosive-urethane systems. By utilizing the Fast Clad Urethane/Fast Clad DTM Urethane system the shipyard/applicator can save one full coat of labor, along with the associated time for access, dehumidification, scaffolding/ staging, etc. All of this can be accomplished without sacrificing long-term performance.

Sherwin-Williams continues to expand its international operations and is also aggressively seeking global partners to enhance its capabilities and provide the services that its marine customers require, according to Mr. Bosanac. The company recently opened two manufacturing locations in China. 



Photo courtesy of Jotun.

tal profile when compared to tributyl tin. It rapidly biodegrades and neither the parent nor its metabolites are persistent in the environment. Also, the metabolites are over 10,000 times less