

Underwater painting sounds like some sort of parlor trick, but there are actually a number of epoxy coatings and repair products that can be applied to damp, wet, saturated, or submerged surfaces as well as used in environments of very high humidity. Typical work sites can include pits, sumps, underwater supports, boats, piers and pilings and all sorts of below grade structures. The ability to patch, seal, encapsulate, reinforce, and protect objects, in place and in wet environments, is a much more attractive option than the alternative which is usually demolish and rebuild from scratch.

Despite the obvious advantages of moisture tolerant coating/repair products, such epoxies are not widely known or understood. The concept of underwater painting remains out of the belief of most industrial and marine maintenance professionals. However, with a slowing economy and fewer replacement dollars available, in situ rehabilitation or repair of existing structures, be they docks, yachts, ships, or dams, is becoming more of a more likely option. In some cases the object might not be exactly underwater, just water saturated. An example would

be an empty cement pit, manhole or sump that has contained water for many years. The cement is completely water saturated and will remain so for a very long time.

Epoxy Basics

First formulated in the late 1930s in the U.S. and Switzerland, epoxies can be considered a two-part, thermoset plastic. Mix two liquid components together, a heat producing reaction (known as $\Delta E_{\text{exotherm}}$) occurs, and a hard product results. Some basic and general characteristics of epoxies are: 1) easy cure temperatures, generally from 5-150 degrees C; 2) low shrinkage; 3) high adhesive strengths; 4) high mechanical properties; 5) high electrical insulation; and 6) good chemical resistance. With so much going for it, epoxies were produced as commercial adhesives in 1946 and as commercial coatings by 1947. The versatility of epoxies was further advanced with the early formulations of epoxies that could be applied in an uncured state to wet surfaces. These special epoxies have evolved from rather crude, unfriendly products into high performance, applicator friendly coatings.

Epoxy Curing Agents

The curing agent selection plays the major role in determining many of the properties of the final cured epoxy. These properties include pot life, dry time, penetration and wetting ability. Curing agents come in many different chemical flavors, generally based upon amines or amides. Amine based curing agents are considered to more durable and chemical resistant than amide based curing agents but most have a tendency to blush, in moist conditions. Blushing produces a waxy surface film on actively curing epoxy, the result a reaction with the curing agent and moisture in the air. Other potentially toxic chemicals within the curing agent can also be released in the same manner, thus amines are often viewed in light of these potential shortcomings. Amides, on the other hand, are more surface tolerant and less troubled by moisture. Fortunately for epoxy end-users involved with underwater applications, there is a small subgroup of non-benzene ring structured amines that maintain all the benefits of amines while removing the toxic leachability and moisture attracting properties of typical amines. These spe-

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Set Your Sails for Corpus Christi, Texas

February 23-25, 2004

The Harte Research Institute at Texas A&M University-Corpus Christi and The Port of Corpus Christi are co-hosting the second *Américas Unidas*. Honorary Chair **Dr. Sylvia Earle** will lead this dynamic conference with topics including *Changing Coastal Demographics, Ecology & Environment of the Gulf of Mexico and Fisheries of the Gulf of Mexico*.

Confirmed Speakers Include:

Dr. John W. Tunnell, Jr., Director Texas A&M-CC Center for Coastal Studies

Dr. Quenton Dokken, Associate Director TAMUCC Center for Coastal Studies; Executive Director Gulf of Mexico Foundation

Dr. Larry McKinney, Sr. Division Director, Aquatic Resources, Texas Parks and Wildlife Department



AMÉRICAS UNIDAS

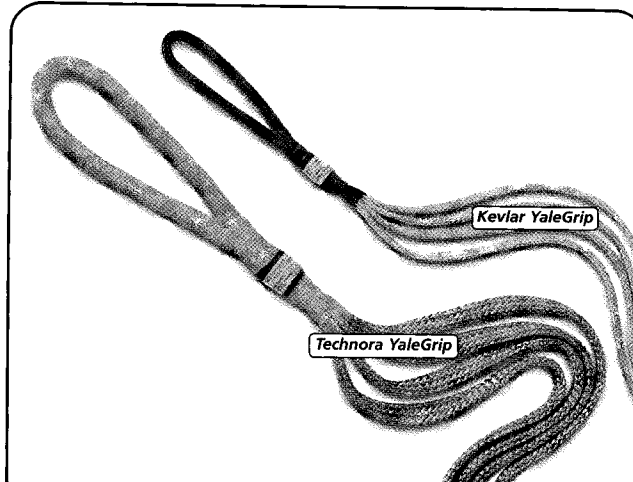
For more information or to register online, visit www.portofcorpuschristi.com

Product News

In conjunction with their attendance at Oceanology International 2004, CodaOctopus is to run a series of 'Master Class' training courses covering their popular geophysical survey and motion sensing product ranges. Taking place close to Excel, the half-day courses are scheduled so as to enable delegates to optimize their time in London and incorporate a visit to the exhibition. Master Class modules can be combined to provide in-depth training to suit customers' specific needs. Run by the highly experienced CodaOctopus technical support team, which includes geophysicists, all course modules promise to provide invaluable training for users at all levels. Training courses will focus on the Coda GeoSurvey, Octopus 361/461 and F180 ranges and content will include basic operation (seismic and sidescan), advanced seismic processing and interpretation, optimizing mosaics and mosaic interpretation; Octopus 361/461 sub-bottom interpretation and sidescan mosaicing operation; Octopus F180 installation, configuration and operation. Individual training modules are priced at £75 (excluding VAT) including refreshments and training materials, with a 25% saving when three or more modules are booked. Demand is expected to be high and places are limited, so early booking is advised. *Reservations can be made and more information is available by email: debra.barker@codaoctopus.com*

CARIS has announced the release of version 3.3 of its software for production of S-57 Electronic Navigational Chart (ENC), CARIS HOM ENC, introducing new advanced features for workflow optimization. The S-57 ENC production software of choice for more than 30 nations, CARIS HOM is a set of tools for the creation, editing, update and management S-57 ENCs. HOM software supports the International Hydrographic Organization (IHO) ENC and River/Inland Waterway product specifications. Version 3.3 of HOM will reduce the overall production time. This is accomplished by introducing methods for reporting quality assurance results, by providing ongoing feedback to users in the correction of errors, and by drastically reducing the amount of time required for data validation and error correction procedures. Features of CARIS HOM include: tools to view chart objects in S-52 and INT1 presentations, preform on-the-fly coordinate transformations to WGS84 datum, tools to check the Skin of the Earth and cell integrity, wizards to generate ENC datasets and updates and conversion of Digital Nautical Charts® (DNCs) to ENCs, among others. CARIS HOM is part of a complete suite of marine and hydrographic software from CARIS. **Circle No. 138**

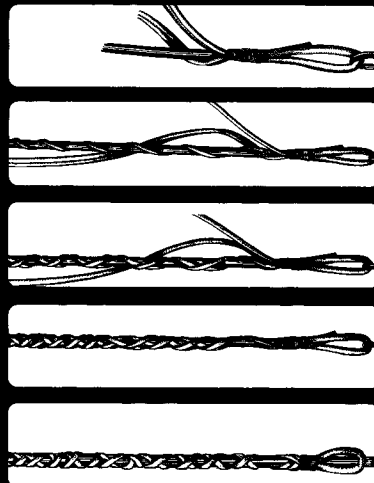
The all-new Ocean Optics HR4000-UV-NIR High-resolution Miniature Fiber Optic Spectrometer enables scientists to perform multi-wavelength analysis over a broad 200-1100 nm range with 0.5 nm resolution. Available for \$3,999, the pre-configured HR4000CG-UV-NIR provides application flexibility, as it is ideal for irradiance, emission, absorbance/transmission and reflectance measurements. The HR4000CG-UV-NIR can be combined with Ocean Optics light sources, sampling accessories, optical fiber and software to create complete UV-NIR systems. The HR4000CG-UV-NIR is a Plug-and-Play USB 2.0 device that interfaces to a PC via a USB port or an RS-232 port. When interfaced to a PC via the USB port, the HR4000CG-UV-NIR is powered from the PC and does not need an external power supply. **Circle No. 139**



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The well known adhesion of epoxies is due to the strong polar bonds it forms with the surfaces it comes in contact with. On dry surfaces the bond between the surface and the epoxy displaces the air, which is a fluid. The same is true underwater. As on dry surfaces, the polar bond attraction is strong enough to displace the fluid, in this case the water, and produce an strong bond even underwater. Thus, painting underwater is, in theory, no different that painting above the water. The cross linking reaction of epoxies should be independent of the surrounding environment. Still most curing agents will react with water molecules rather than the epoxy base, resulting in a waxy film, mentioned above, known as amine blush. This makes them unsuitable for underwater application.

Epoxies bond to surfaces at the molecular level by tiny electrical charges. Sometimes in marine settings there can be pre-existing electrical charges in the underwater environment that interfere with the bonding mechanism of the coatings. Such electrical cells can be either intentional or accidental. Active or passive cathodic protection systems, designed to protect against underwater corrosion, will produce electrical fields that disrupt coating bonding. Dissimilar metals in the immediate vicinity (identified or unidentified) will also produce stray electrical fields. Even chemicals and pollution in the water may be responsible for or enhance the voltage of existing underwater electrical cells. The problem is more often observed in dirty harbors, full of unidentified metal junk, and chemical/industrial waste. Even ongoing arc welding on a ship will produce electrical charges on and around the hull. Ships tied to dockside facilities with their own cathodic protection systems or sloppy electrical systems, can cause underwater coating bonding problems on conductive (metallic) surfaces. Generally there is no problem on non-conductive surfaces such as concrete and wood, or in fresh water. The method to evaluate the application and bond of underwater coatings on conductive metallic surfaces in seawater is not in a bucket of harbor water, but under actual conditions. What bonds and works well at Dock A, may not work at Dock B or when tied up to Facility C due to identified or unidentified electrical charges at that site. Almost without exception, bonding problems associated with CEunderwater painting[®] are site specific and related to electrical cells formed in a conductive medium

(seawater) on a conductive surface. Always test in the actual marine environment before committing to any underwater coating project. If there is a problem, the epoxy will simply refuse to **C**estick, to the surface. It is very obvious (and embarrassing). It often will not transfer off the brush, roller, or paint pad/glove.

Concrete structures, often commercial in nature, can sometimes have adhesion problems too. Commercial aquariums and swimming pools are examples. In some cases chemicals were added to the concrete to speed curing, reduce air bubbles, etc. These chemicals, some perhaps silicon based, prevent bonding of the epoxies to the concrete. It is also possible (I don't have proof) that some pool/aquarium paints also contain stain or slime (Eno-stick, chemicals that make underwater coating impossible. I know of commercial aquariums where some the underwater epoxies work fine and others where they don't work at all. The only safe thing to do is test before taking on such a project.

The underwater applied coating market remains a small niche within the much larger industrial and marine maintenance marketplace. Both first and second generation underwater coatings are still widely in use, primarily because of the conservative nature of the industry and the acceptance of less than user friendly underwater products. Too few users and potential users/applicators of underwater coatings are aware of the advances made in recent years. This is changing as the shift toward environmentally friendlier, and easier to use coatings is slowly causing the re-evaluation of old familiar products and the introduction of new companies with new products that better meet today's expectations. The ability of a single product to be effectively used on dry surfaces, underwater, or on saturated or dripping metal/concrete surfaces, while being both environmentally and user friendly, represents a technology that will continue to gain acceptance. The savings associated with in-situ underwater repairs and coating projects is often easy to document, as are the potential benefits from even more ambitious applications of this maturing coating technology.

For more information contact: Paul Oman at Progressive Epoxy Polymers, Inc., Frog Pond Hollow - 48 Wildwood Dr - Pittsfield NH 03263 , 603-435-7199, info@epoxyproducts.com <http://www.epoxyproducts.com>

ON&T January/February, 2004

People & Company News

Oceaneering International, Inc. announced it has selected a facility in Panama City, Florida as its new U.S. location for the manufacture of steel tube and thermoplastic umbilicals. The existing facility, to be procured under a long-term lease, has direct load out capability to 32 ft. of water, a 300-ton dockside boom crane, and will have nearly 200,000 sq. ft. of plant space after modifications. Oceaneering will install \$25 million of state-of-the-art equipment in this facility, including the most technologically advanced steel tube-cabling machine in the world. The machine's features make it one of the most productive machines in the industry for the manufacture of long, continuous length production control umbilicals. Manufacturing will commence in the Panama City facility during the third quarter of 2004.

Douglas W. Swain, President of DWS International Inc (DWSII), Corpus Christi, Texas announced DWSII will provide worldwide marketing, sales and support of Sea Mac Marine Products, Inc. (SMMP), Houston, Texas winch products. DWSII will provide sales and

support services for both the new and existing winches in the field as well as provide upgrades of the SMMP products. DWSII has been providing new and used marine geophysical equipment, integrated systems and support services for the offshore survey markets since 1986. Mr. Swain also announced, Poseidon Energy Services, Inc., a sister company of DWSII, has begun designing and manufacturing this new product line of winches and deck systems for wire and umbilical handling systems at their Corpus Christi, Texas facility.

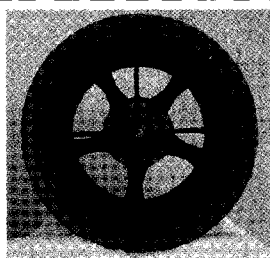
Effective January 1st, 2004, Coastal Oceanographics changed our name to HYPACK, Inc. This change reflects the fact that most of our clients refer to us by 'HYPACK', our principal product. In early 2004, HYPACK will also be moving to their new offices in Middletown, CT.

The Marine Advanced Technology Education (MATE) Center has been selected as the 2004 Offshore Technology Conference's (OTC) invited organization.

Flotation Technologies, Inc., a global leader in deepwater buoyancy systems, has announced it has been award-

ed ISO 9001: 2000 certification for Quality System Management by TUV. The ISO 9001 Standard is an internationally recognized quality management system developed by the International Organization for Standardization (ISO). ISO 9001 assures through independent confirmation that all design, manufacturing and sales processes adhere to this quality standard and establishes the requirement for companies to understand customers needs, implement a documented quality system and deliver products that meet customer expectation.

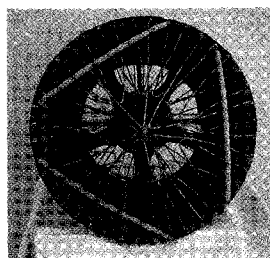
Oceanwide, a leading international employment agency in the maritime and offshore field, announced today the further expansion of its fast-growing network of branch offices by the opening of a new branch office in Odessa in the Ukraine. The expansion is built on Oceanwide's growth and expansion strategy as well as on its growing client base in this region. The opening of this office adds to the recently acquired operations in Oslo, Norway. Oceanwide Ukraine will be headed up by Managing Director Mr. Alexander Zhuravskiy.



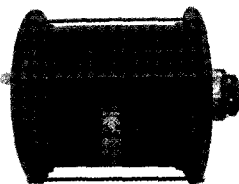
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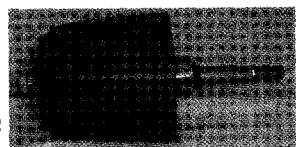
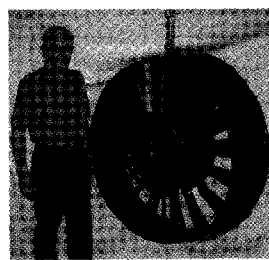
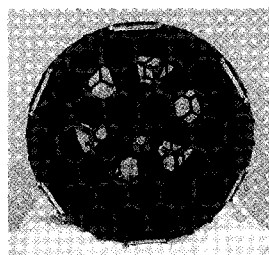
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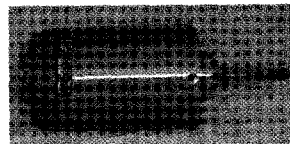


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*U.S. Patent 4,726,183 & 6,152,793.
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