Cork Tech TalkNews

Manufacturers of Waterbase, UV+EB Curable Coatings, Varnishes and Adhesives

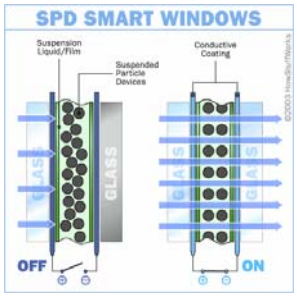
08/05

SMART COATINGS EXCITE!

Smart coatings are the talk of the global coating community. Suddenly conferences and seminars are springing up world wide to bring the subject to the forefront of research.

Smart coatings can be defined as a structured coating system that can sense its environment and formulate a planned response to an external stimulus. These special coating systems are designed to react to outside conditions, in a certain specific manner. The stimulus might be heat, stress, strain, pressure, humidity, pH, bacteria, virus, vibrations, magnetic or electronic fields, electromagnetic radiation, chemicals, etc.

There are already many examples of smart coating systems working for us. Smart windows are a perfect example of a smart coating working for us. Windowpanes of glass are coated with a thermochromic material, whose heat reflectivity changes with the temperature of the pane. Depending on ambient temperature the window can switch from heat adsorption to heat reflection.



Suspended particle windows (SPD) produce another type of smart window. This new technology allows one to control the amount of light being transmitted, from clear to dark.

Another approach to produce energy efficient windows uses a group of wavelength selective coatings that make-up heat mirrors.

Electrochromatic materials are giving us auto dim rearview automotive mirrors that adjust to allow varying levels of visibility.

Yet another novel innovative smart coating product is Caliwell™ coating that produces an antimicrobial - antibiotic surface protecting against all classes of microbes including, algae, bacteria, fungus and viruses, acting to prevent infections. It is a waterborne, low VOC, virtually odorless, high alkalinity pH 12.4 surface coating based on polyolefin latex and cellulosic polymer, and calcium hydroxide. The product is actively sold and is protecting many facilities where it is employed.

Functionally, graded materials are used to produce a multilayered, continuously graded surface treatment, designed to provide optimized performance. In this case, the performance involves a combination of wear and corrosion. One application of this smart coating technology is found in the coating of a twin-screw extruder barrel used in the food processing industry where wear/corrosion depends on the product being processed.

Smart coatings are basically not smart in themselves since they possess no in board built in intelligence. The response called “smart” is the result of a combination of coating properties. Smartness is the result of input from the “smart” coating formulator.

The intelligent, “smart”, combining or formulating of materials along with novel processing technologies are being used to produce coating systems that demonstrate smart concepts.

A coatings’ sensor agent, (smart properties), could be a polymer, an additive, a pigment, thermochromic, piezoelectric, ferroelectric materials, metal-insulator transitions, non-linear dielectrics, shape memory alloys, etc.

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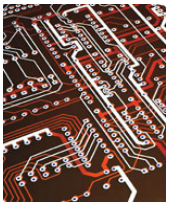
Smart coatings will conceivably be formulated from sensor principles such as systems:

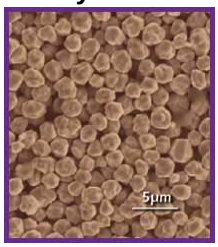
- **that release color upon coating damage from micro-encapsulated dyes and pigments**
- **that incorporate pigments that absorb corrosive chemicals.**
- **that change from (a non-fluorescent state to fluorescent state) when subjected to oxidation or complexing from metal cations.**
- **that change color when responding to pH changes stemming from corrosive processes.**
- **that release corrosion inhibiting chemicals when sensing a corrosive process.**

The future, however, will bring true intelligent coatings that will benefit from the adding of true smart devices as microprocessors, micro actuators, and micro sensors.



Radio frequency identification tags (RFID) using printed integrated circuitry are already in production and slated for quick growth as Wal-Mart and others adopt them to identify merchandise.

The United States Government is funding research to develop corrosion and anti-fouling ship coatings, as well as coatings that will provide protection in hostile environments and afford protection against moisture, dust, chemicals and fungus. They also are funding research to produce smart coatings to allow military vehicles to self heal, detect & repair themselves when corroded or scratched. There is also interest in coatings that would allow military vehicles to undergo color change (chameleon-like) on the battlefield to afford continuous camouflage. Aerospace interests include smart coatings that will respond to sensed damage, changing color when appropriate, improving resistance to corrosion, fatigue, pitting, oxidation. These smart coatings are envisioned to be activated by nano-technologies, nano-machines.



Smart coatings have also been developed in the area of hygienic coatings. For example, silver ions have been included in polymers to formulate smart coatings to limit the growth of mold, mildew and bacteria on metal products. Applications abound in the food processing, medical, HVAC and appliance industries.

Consider the breadth of the subject matter to be considered for the Smart Coatings Conference in Orlando Feb 2006 to get an idea of where things are going.

- **Bioactive coatings**
  - **Antimicrobial polymers, coatings, pigments and additives**
  - **Bio-decontamination/detection**
  - **Antifouling coatings**
- **Nanotechnology-based coatings**
  - **Coatings functioning as sensors**
  - **Molecular electronics**
  - **Conductive polymers and coatings**
- **Stimulus and responsive**
  - **Coatings functioning as sensors**
  - **Corrosion, degradation and defect sensing coatings**
  - **Light sensing coatings**
- **Self-assembled intelligent layers**
  - **Self-repair and healing coatings**
  - **Self-lubricating coatings**
  - **Optically active coatings**

Another avenue being researched are coatings with molecular memory that will use nucleic acids to store electronic data.

Coatings are also being actively explored to function as displays, where extremely thin liquid crystal displays (LCDs) can be made by light-induced photochemical curing process polymerization.

This entire field is tremendously active with many research and development projects funded. This newsletter only touches the surface of what is an ambitious global activity seeking futuristic novel new coating products.

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