Crystal IS™
High Performance UVC LEDs

Optan SMDs for Biofilm and Biofouling Control

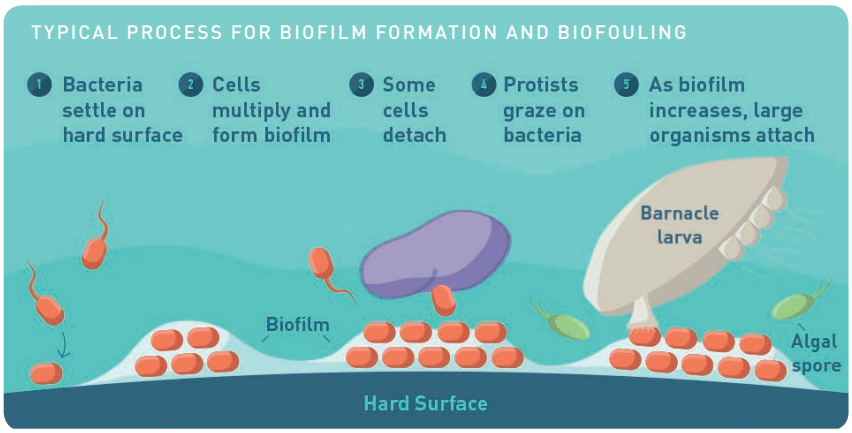
Biofilm and biofouling have an adverse effect on all types of instruments and sensors, especially those that are used in coastal and marine environments. Biofouling can affect every type of sensor; it impacts electrical sensors used for measuring conductivity, pH, optical sensors used for measuring organic content, acoustic sensors used for measuring ocean currents, and other instruments such as cameras for underwater imaging and lenses for optical communication. Within hours of deployment, bacteria can start to settle on the surface of the instrument and multiply to form biofilm.

If left untreated, the biofilm will continue to build on the sensor and larger organisms will attach to the film, adversely affecting the quality of measurements. The Alliance for Coastal Technologies estimates that maintenance costs due to biofouling account for 50% of operational budgets. In the United States alone, the annual economic impact of biofilms is estimated to be at least $200 billion.

Applications:

> BIOFILM PREVENTION AND BIOFOUL CONTROL

> BIOREACTOR DECONTAMINATION



Traditional methods

There are several traditional methods of anti-fouling (or biofouling control) that have been used in spite of inherent limitations. Biocides are effective, but they on the decline in recent years due to concerns for the environment. One of the most effective biocides from the past 40 years, Tributyltin (TBT), was banned in 2008 due to its toxicity to other organisms and the environment. Tin or copper plating can limit biofilm formation, however these methods are not successful in all environments. Mechanical methods, such as wipers, have a high failure rate, need to be customized for every surface, and have relatively high power consumption. Given the high cost to the industry, many instrument manufacturers are looking for new ways to control biofilm that are both environmentally friendly and effective.

COMPARISON OF TRADITIONAL BIOFOULING CONTROL METHODS

TECHNOLOGY	BENEFIT	LIMITATION
Mechanical wipers/shutters	• Established technology • Environmentally friendly	• High faillure rate • High power consumption • Must be customized for every surface • Effective in early stages, but not fully preventative
Tributyltin (TBT)	• Established technology • Effective for full prevention	• Toxic • Banned due to regulations
Copper paints	• Works in marine environments • Effectiveness of three months/ one year	• Not as effective in freshwater • Can result in galvanic reactions
Other non-toxic coatings	• Works by preventing attachment • May be cost effective for large areas	• Most coatings are not optically transparent

A new source of protection

Radiation in the UVC wavelengths from 250 – 280 nm can provide a new solution to this industry-wide problem. Light in these wavelengths deactivates bacteria, viruses, and other microbes by destroying the genetic information inside the DNA. This prevents the formation of a biofilm, thus hindering the later phases of biofouling where larger organisms attach to the instrument.

Although the potential of UVC radiation for biofouling control has been known for some time, mercury lamps were traditionally the only viable source of UVC light. These lamps are cheap and provide ample light in the UVC wavelengths. However, they are bulky, consume a great deal of power, and are not environmentally friendly.

High performance UVC LEDs from Crystal IS offer a viable alternative for UVC radiation. LEDs are compact, environmentally-friendly, and have low power consumption. In addition, their radiation pattern can be easily tailored to the size and shape of the surface to be protected.

The Crystal IS advantage

Crystal IS Optan LEDs are grown on aluminum nitride (AlN) substrates, and have a million times fewer defects than LEDs fabricated on sapphire substrates. The lower defect density results in a 5-10 times higher light output and longer lifetime for Optan LEDs, making them a viable option for biofouling control. Optan SMD LEDs are optimized for DNA deactivation and can also be operated at relatively high drive currents for maximum protection against biofilm formation.

The introduction of brighter, more powerful UVC LEDs has created new opportunities for the use of LEDs in controlling biofouling while minimizing electrical power consumption. Using UVC LEDS as a solution for biofouling control is enabling longer lengths of marine deployment and significantly reducing operational and maintenance costs.

We invite you to learn more about our UVC LEDs.

Crystal IS™
High Performance UVC LEDs

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