Cold Spray Antifouling of Marine Seismic Streamers

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Cold Spray Antifouling is a new antifouling technique designed for polymers. Here, we apply it to the flexible polyurethane jacket of marine seismic streamers.

Low surface energy polymers present a problem for antifouling treatments as coatings tend to peel off. Cold Spray Antifouling embeds particles such as copper into the polymer surface.

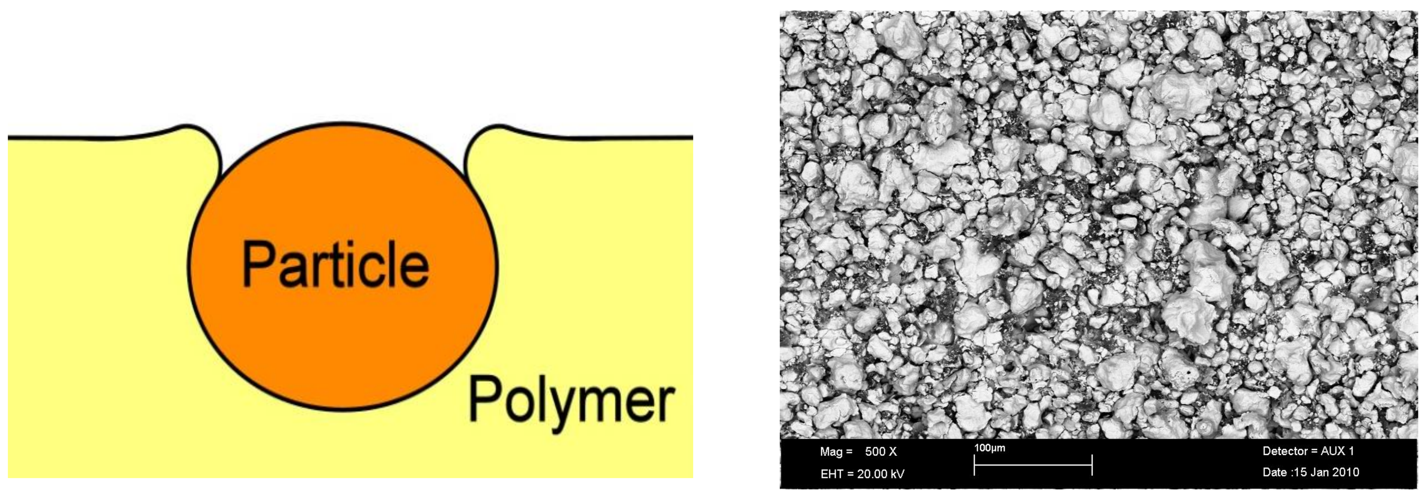

Figure 1. Schematic representation of an embedded particle, and an SEM of polyurethane showing the embedded particles forming a discontinuous layer.

The particle is physically held by the polymer, no chemical bonding is required, and the polymer remains flexible.

Seismic streamers used in the geophysical exploration for oil and gas contain sensor arrays in a polyurethane-jacket that is prone to fouling. No viable antifouling treatments are available and so fouling necessitates *in situ* cleaning on the high seas to prevent deterioration in survey data quality and over-tensioning of the streamer, which is towed at 4.5 knots.

Figure 2. Streamers are fouled by pelagic goose barnacles. Cleaning poses OHSE risks and creates an unpleasant working environment.

Using cold spray[1], half the length of 600 mm samples of streamer jacket (Colex) was embedded with copper particles to produce high-density (101.1 g/m^2 copper) and low-density (22.1 g/m^2) samples. These were deployed (n=3) in the tropical waters of Townsville harbour, Queensland, Australia (Fig 3). Fouling was quantified for front-facing and back-facing (100 mm from the harbour wall) surfaces over time, and fouling attachment strength measured[2].

Figure 3, High-density copper coated streamer jacket before deployment, a light micrograph of the surface, and being deployed in Townsville Harbour (L to R).

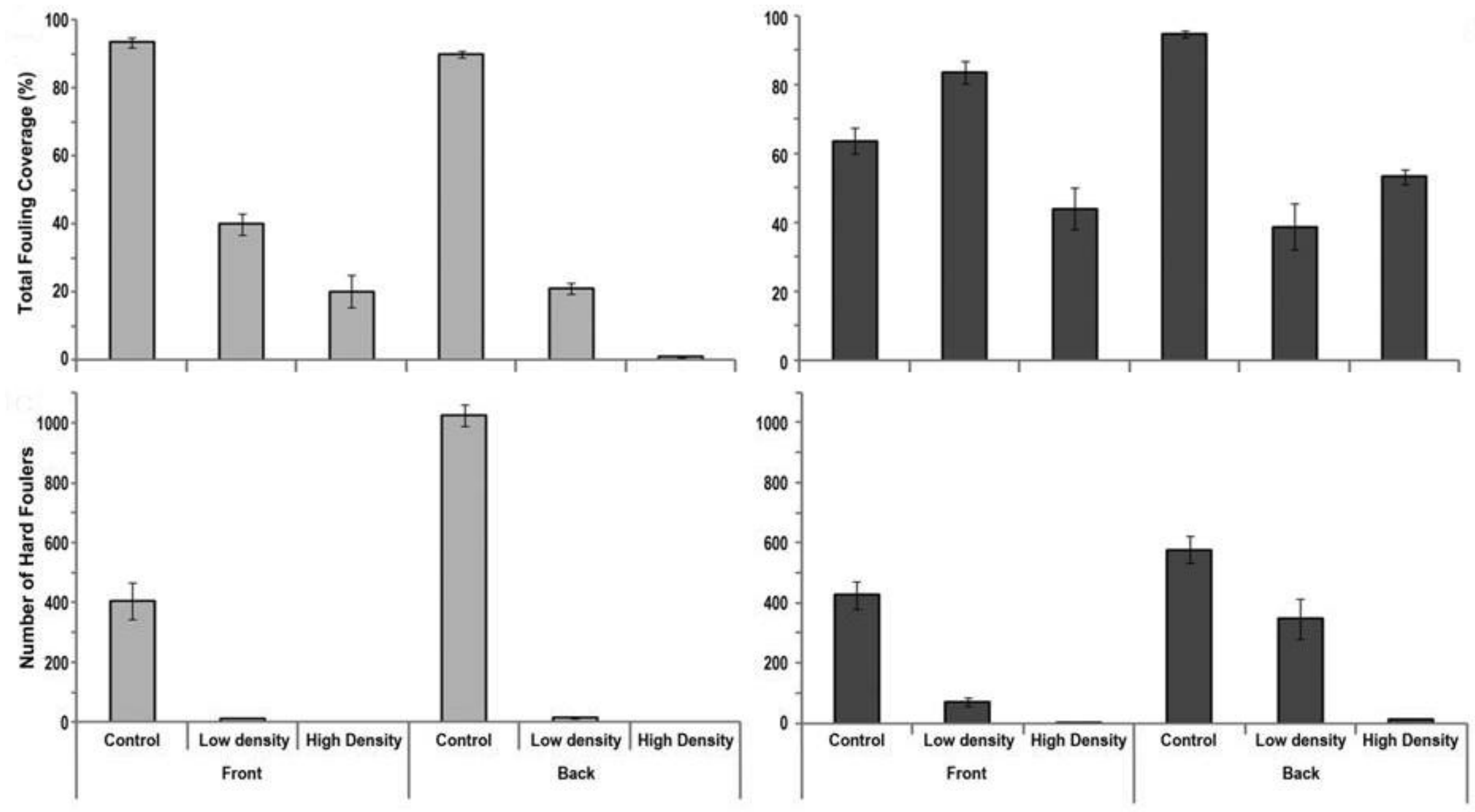

Figure 4. Fouling of streamer jacket after 42 days (L) and 210 days' (R) field exposure in Townsville Harbour.

Control samples fouled within 14 days and colonisation continued unabated. The low-density coating was effective for 42 days and the high-density coating for 210 days before the first hard fouling organisms settled (Fig 4,5). This sequential loss of efficacy suggests the copper was depleted.

At 210 days, the mean number of hard foulers ranged from 2.5 ± 0.7 for front-facing high density streamers, to 577.3 ± 44.6 for back-facing polyurethane controls. All samples were fouled with copper-tolerant Ulva sp., accounting for the greater Total Fouling Coverage. The copper treatment had no effect on fouling attachment strength under 4.5 knots water flow.

Figure 5. Streamer jacket high-density sample after 210 days field exposure in Townsville Harbour, showing the interface between the sprayed and unsprayed area.

This work shows cold spray embedded copper has promise for being an effective method of preventing marine growth on seismic streamers. The next step is to increase longevity through choice of metal type, embedment depth and particle size.

FOR FURTHER INFORMATION

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