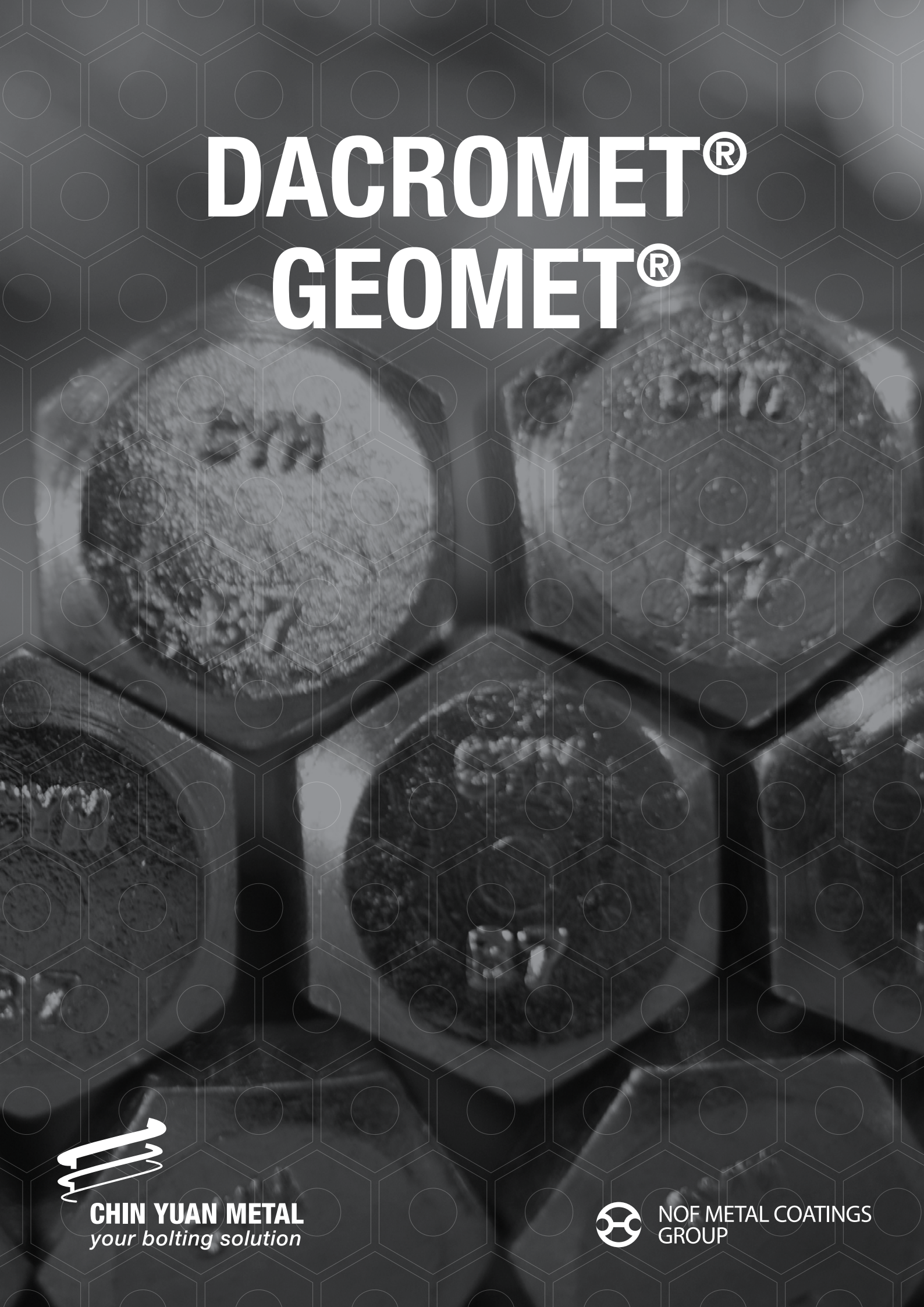
DACROMET®
GEOMET®



CHIN YUAN METAL
your bolting solution

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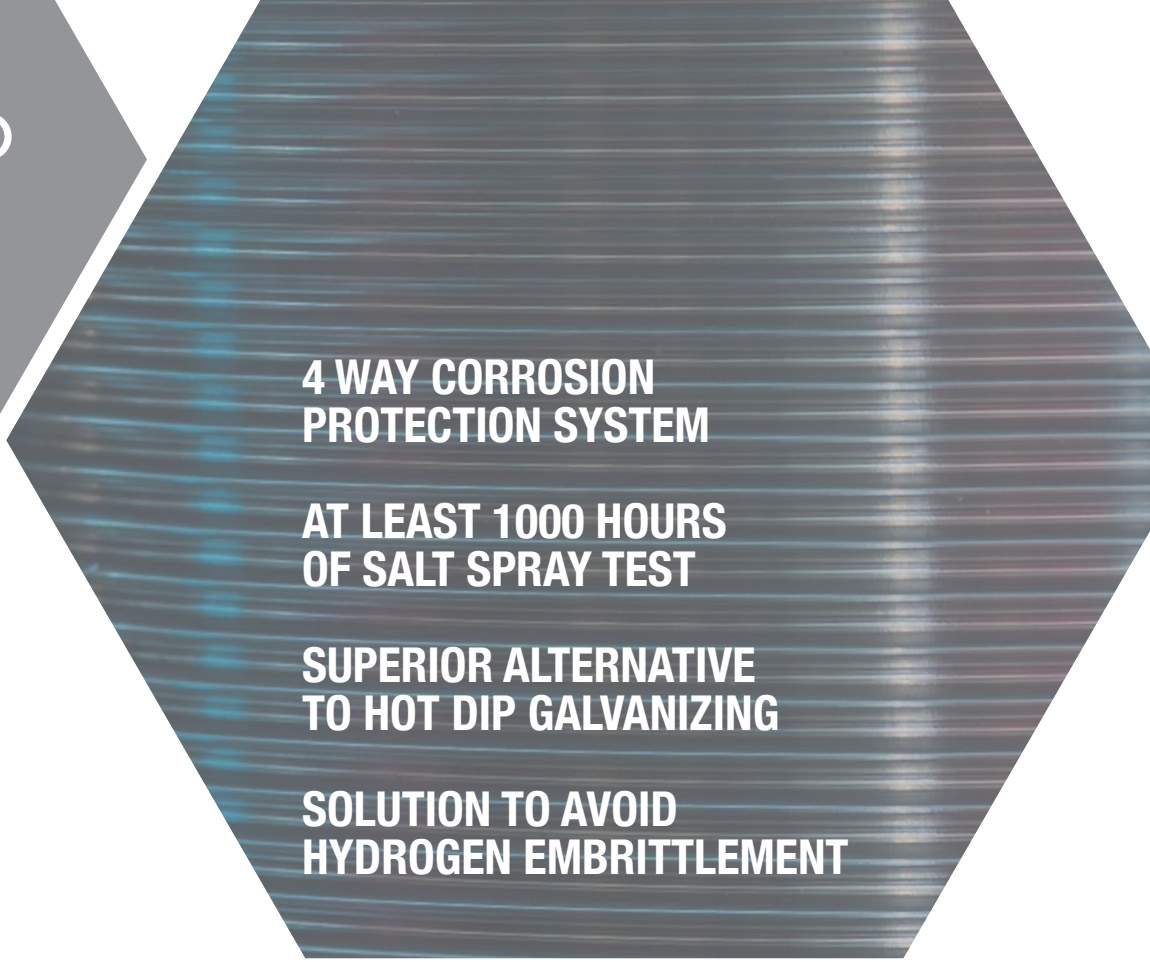

4 WAY CORROSION PROTECTION SYSTEM

AT LEAST 1000 HOURS OF SALT SPRAY TEST

SUPERIOR ALTERNATIVE TO HOT DIP GALVANIZING

SOLUTION TO AVOID HYDROGEN EMBRITTLEMENT

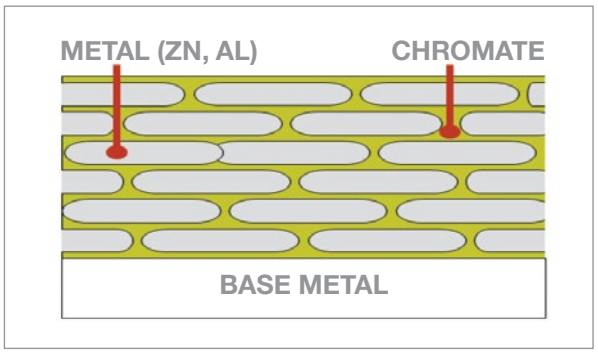

Figure 1: Film Structure of DACROMET®

DACROMET®

DACROMET® is a coating solution made up of Zinc and Aluminum flakes in chromic acid. Figure 1, shows the coating system for DACROMET®. This coating system exists uncured as a zinc and aluminium flake suspended in aqueous chromic acid. In the uncured form, it is a water based suspension, but when cured, the chromic acid forms an inorganic chromate binder that enhances corrosion resistance.

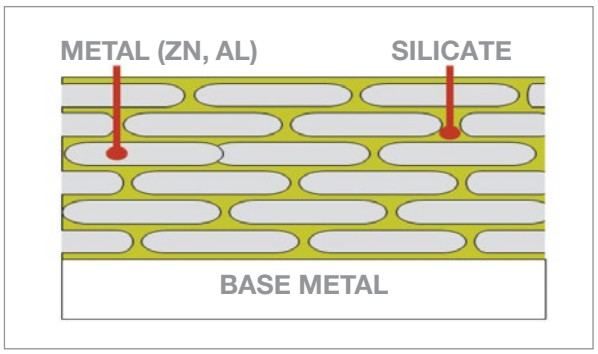

Figure 2: Film Structure of GEOMET®

GEOMET®

GEOMET® is also a Zinc and Aluminum flake coating system but is designed to meet environmental requirements imposed by many countries by creating an aqueous replacement for the chromic acid used in DACROMET®. As GEOMET® is a water based coating, it does not cause any damages to the environment and is ELV and RoHS compliant.

Both DACROMET® and GEOMET® are able to provide high corrosion resistance while maintaining a thin layer of coating (approximately 8µm). Hence, it allows the bolts and nuts to have a good trial fit without having to alter the thread dimension. The Zinc and Aluminum flake in DACROMET® and GEOMET® are particle size and when applied onto the base metal, forms overlapping layers as seen in the figures above. The overlapping layer of Zinc and Aluminum acts as multiple layers of thin coating that significantly increases the corrosion resistance.

**"Hydrogen embrittlement may cause premature failure of parts which are heat treated or cold worked to a surface hardness of 320HV and above or property class 9.8 or above."
BS 7371-6**

SOLUTION TO CORROSION RESISTANCE

DACROMET® and GEOMET® coating system allows for a unique 4 ways of corrosion protection as shown in figure 3.

1. Barrier protection: Each layer of overlapping Zinc and Aluminum flakes creates a barrier of protection.
2. Galvanic action: Sacrificial protection of Zinc protects the base metal from corrosion.
3. Self-repairing: Zinc and Aluminum flake layers form oxides that is able to fill up damage areas of the coating.
4. Passivation: Inter-layer inorganic barrier slows the sacrificial protection of Zinc.

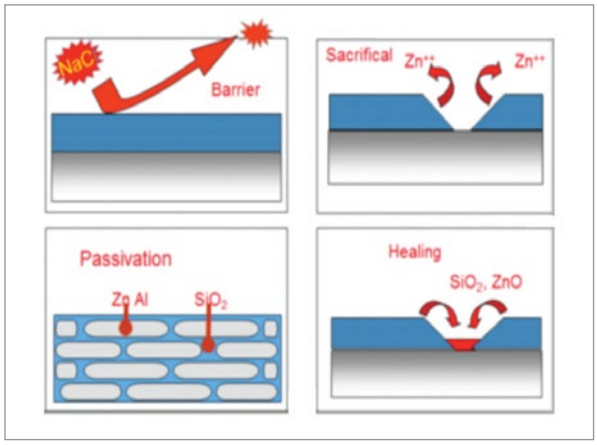

Figure 3: 4-Way Corrosion Protection

AT LEAST 1000 HOURS OF SALT SPRAY TEST

One layer of DACROMET® and GEOMET® has demonstrated 0% red rust after 1000 hours of Salt Spray Test hours (tested against ASTM B117). This performance exceeds that of Electro-Galvanizing, Hot Dip Galvanizing and Mechanical Galvanizing. The corrosion resistance capability can be further enhanced by applying multiple layers of coating. Alternatively, DACROMET® and GEOMET® can be trusted as a base coat to be applied with other top coats. The inorganic base coat protects the substrate from any chemical reactions and the overall corrosion resistance will be increased exponentially.

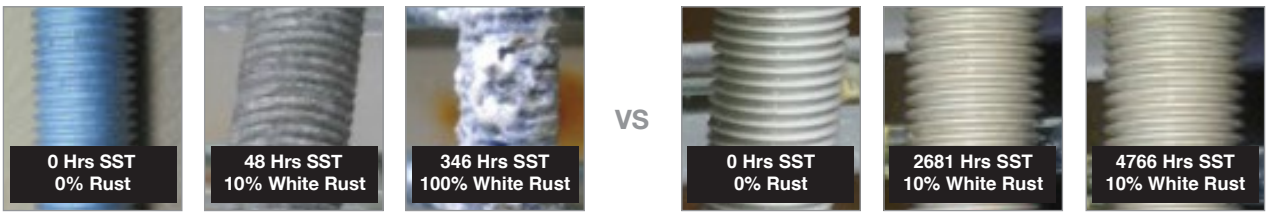

Figure 4: Comparison of Hot Dip Galvanized and GEOMET® coated Bolts after respective hours of Salt Spray Test

SUPERIOR ALTERNATIVE TO HOT DIP GALVANIZING

DACROMET® and GEOMET® coated fasteners have demonstrated superior corrosion resistance performance compared to hot dipped galvanized ones. When we performed salt spray test as per ASTM B117 on both types of bolts, hot dipped galvanized bolts began to have 10% white rust at approximately 48 hours whereas DACROMET® and GEOMET® coated bolts are still in exhibiting 0% white rust and red rust after 1000 hours of salt spray test.

In addition, hot dipped galvanizing requires a minimum coating thickness of 36 microns. To compensate for the fit between bolts and nuts, ASTM A153 allows the nuts or tapped holes to be tapped to meet over-tapping allowances. DACROMET® and GEOMET® do not require any reworks as the average coating is only 8-10 microns.

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SOLUTION TO AVOID HYDROGEN EMBRITTLEMENT

Electrolytic and acidic processes are liable to produce hydrogen embrittlement. Hydrogen embrittlement on high hardness steel (320HV and above) remains a prevalent concern for many. Supporting literature includes standards such as ASTM A143 (2007) and BS 7371-1 (2009). This has an impact on commonly requested materials such as Hot Dipped Galvanized BS 4190 Grade 10.9 bolts and nuts. When Grade 10.9 bolts and nuts are sent for hot dipped galvanizing, the fasteners undergo an acid pickling process, making the steel materials susceptible to hydrogen atoms diffusing into them. The hydrogen molecules then create the pressures from inside the cavity and cause the bolts and nuts to crack. Other materials deemed unsuitable for hot dipped galvanizing include BS4395 Part 2, SAE Grade 8, ATSM A490 and JIS B1186 F10T.

HIGH TEMPERATURE OF ZINC BATH AFFECTING THE FASTENERS

According to ASTM F2329, normal galvanizing is carried out at a bath temperature of 435 - 480°C. These normal galvanizing baths can “adversely affect the final mechanical properties of fasteners”. The result of the affected mechanical properties include reduced tensile strength and yield strength. DACROMET® and GEOMET® avoid these problems completely as the entire coating process is performed below 380°C. Therefore, the mechanical properties of the raw materials remained uncompromised.

Cause 7.2.3 also indicated that externally threaded fasteners of 1” (M24) and above of a hardness of HRC 33 and above shall not be hot-dip zinc coated to avoid micro cracks caused by the high galvanizing temperature. Therefore, it is essential that system engineers be aware of this risk and consider using alternative coating that can offer similar or better corrosion resistance while maintaining the integrity of the fasteners.

CURRENT MARKET FOR DACROMET® and GEOMET®

DACROMET® and GEOMET® are widely used in the offshore, construction, automotive, rail and wind turbine industries, where shelf life, performance, integrity and corrosion resistance remain critical considerations. Companies who endorse DACROMET® and GEOMET® include Petrobas (Brazil), SBM Offshore Systems (EQ6300001), Vestas (900182), Alstom Transport (DTRF 150213, DTRF 150217 C), Bombardier (BT/CE-WIN 30-02).

ABOUT CHIN YUAN METAL PTE LTD

Chin Yuan Metal Pte Ltd is a leading manufacturer of Bolts and Nuts worldwide. With the philosophy of continuous improvement and customer satisfaction, Chin Yuan Metal has grown from a small hardware enterprise to become a reputable global player today. As we pursue our commitment to service excellence, we begin to expand our services from sales to assisting our customer resolve on-site problems.

We believe that our success lies in prompt response and strong technical support, both highly critical attributes to our customers. These principles have guided us though the years bringing us to where we are now, your bolting solution that is always connecting us to you.

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