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Long-term geothermal study

BRANZ research into materials performance in geothermal environments has provided many insights. A new study continues this work, examining the long-term durability of a range of building materials and coatings.

GEOTHERMAL EMISSIONS have negative impacts on the condition and safety of buildings and infrastructural assets. Four years ago, BRANZ started looking at how typical building materials perform in New Zealand's geothermal environment.

Technical outputs from short-term environmental monitoring and exposure testing gave an insight into the science behind material degradation and also challenged industrial and standard practices.

Materials perform differently

An accelerating and oscillating kinetic behaviour combined with extremely high corrosion rates has been observed with mild steel and zinc in some geothermal environments (Figure 1). This has not been commonly observed in other natural environments.

Aluminium-zinc alloy coatings, a prime choice for durability, demonstrated a service life of approximately 2 years in some geothermal environments. This fell short of expectations and was related to its unique microstructure with aluminium-rich dendritic and zinc-rich interdendritic phases.

Preferential attack on the zinc-rich phases produced numerous surface defects through which sulphur-containing species could readily enter deeply into the coating and attack the steel substrate directly. Coating integrity was quickly compromised with the formation of a large number of cracks and rust spots (Figure 2).

These unusual degradation behaviours could lead to a high risk of premature failure of materials, components or structures.

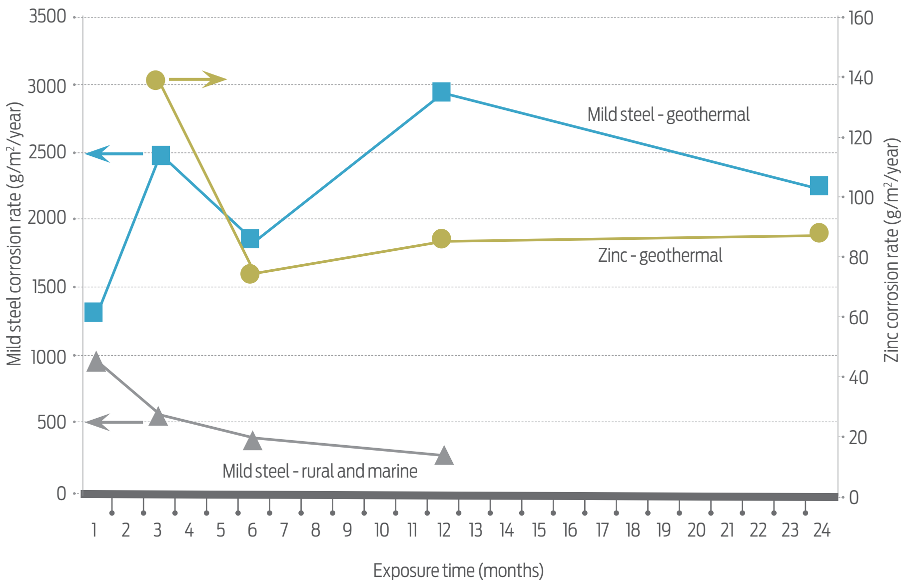

Figure 1: Atmospheric corrosion of mild steel and zinc in New Zealand environments.