

Different Types of Corrosion

- Recognition, Mechanisms & Prevention

Liquid Metal Embrittlement

Recognition of Liquid Metal Embrittlement

What is liquid metal embrittlement? Liquid Metal Embrittlement (LME) refers to environmental cracking caused by contact with a liquid metal. It is also known or as Liquid Metal Cracking (LMC).

There is a specific combination of liquid metals and stressed metals or alloys that can lead to catastrophic intergranular cracking. For example, carbon steels and stainless steels are susceptible to liquid metal embrittlement by zinc and lithium; aluminum and aluminum alloys are susceptible to liquid metal embrittlement by mercury and zinc; copper and copper alloys are susceptible to liquid metal cracking by mercury and lithium. Cracking is frequently observed to be a single intergranular crack that propagates rapidly, at a rate of 25 cm/s.



Mercury-containing items are prohibited by all airlines as they pose a real risk to the structural integrity of the aircraft which is made of aluminum alloys.

Zinc from galvanized steel parts or zinc-rich paints is frequently found to be responsible for the cracking of welded steel components in various industries.

Mechanisms of Liquid Metal Embrittlement

What causes liquid metal cracking?

The mechanism of liquid metal cracking is clearly not electrochemical in nature. It is most probably an adsorption-induced cracking. The liquid metal atoms when adsorbed on a susceptible metal or alloy reduces the metal bond strength within the grain boundary regions of the susceptible metal. Under tensile stress, crack initiates and propagates rapidly along the grain boundaries.

Prevention of Liquid Metal Embrittlement

How to prevent liquid metal cracking? Liquid metal cracking can be prevented through:

- Avoid contact with or contamination by the crack-causing liquid metals.
- Do not use low-melting point metals near their melting points.
- Use metallic coating or cladding as a barrier protection.

For more details on Liquid Metal Embrittlement

Where can I learn more about liquid metal embrittlement? More details on liquid metal cracking are included in the following corrosion courses which you can take as in-house training courses, course-on-demand, online courses or distance learning courses:

Corrosion and Its Prevention (5-day module)

API 571 Damage Mechanisms Affecting Fixed Equipment in the Refining and Petrochemical Industries (5 days)

Corrosion, Metallurgy, Failure Analysis and Prevention (5 days)

Marine Corrosion, Causes and Prevention (2 days)

Materials Selection and Corrosion (5 days)

Stainless Steels and Alloys: Why They Resist Corrosion and How They Fail (2 days)

If you require corrosion expert witness or corrosion consulting service on liquid metal embrittlement (LME), our NACE certified Corrosion Specialist is able to help. Contact us for a quote.
