



DATA SHEET No 9 Titanium & Mercury

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From limited published data and laboratory work it appears that moderate to high stress levels may be required for mercury to affect titanium, and that furthermore, mechanical damage to the protective oxide film appears necessary to permit wetting of the titanium metal surface and allow cracking to occur. It is possible however that low levels of strain may in certain circumstances create sufficient disruption of the oxide film for metal to metal contact to take place and cracking to be initiated.

Firm guidelines cannot be laid down, but in general titanium and its alloys are highly resistant to liquid mercury in situations where severe and or sustained mechanical damage to the surface oxide film does not occur. Since mercury does not 'wet' oxide filmed surfaces, interaction between titanium metal and the mercury (i.e. amalgamation), does not occur. Additionally, industrial conditions are normally such that both the mercury and the surface of the titanium will be filmed or soiled so that intimate metal to metal contact is virtually impossible. Anodising or thermal oxidation which thicken the oxide film can be expected to be beneficial unless plastic straining occurs. The embrittling effects of mercury can be observed on titanium and all alloys in situations where continued and severe surface oxide damage is incurred, such as during excessive straining, (yielding), or where severe and sustained mechanical damage is occurring. (Such damage would in itself then be a greater problem).

Tests performed on commercially pure titanium Grade 2, Ti-Pd alloy Grade 7 and Ti-Ni-Mo alloy Grade 12 produced neither attack nor cracking on U-bend specimens in liquid mercury at 75°C, even when surfaces immersed in the liquid metal were intentionally scratched. No cracking has been observed in sustained-load (constant deflection SCC tests, such as U-bend and C-ring tests in Grades 2, 12 and 29 in hot liquid mercury. Ninety day C-ring tests in liquid mercury at 25°C and 230°C on Grades 29, 19 and 20 seamless pipe stressed to 95% of the yield stress at temperature produced no evidence of attack or cracking. Embrittlement was observed in slow strain rate tests on Grade 29, with severe plastic strain (>110% YS). Most components are however designed to operate well below their yield points and the potentially detrimental influence of mercury is not considered to be a practical concern. In practical use, there have been no cases reported which can be attributed to embrittlement, attack or cracking of titanium by liquid mercury.

Mercury Compounds

Titanium and its alloys are highly resistant to practically all inorganic salts solutions, including those of mercury, over the pH range 3 - 11 and to temperatures well in excess of boiling. Corrosion of Grade 2 titanium in saturated mercuric chloride at 100°C is recorded as an insignificant .001mm/year (.02mpy).

FOR FURTHER INFORMATION CONTACT

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The data and other information contained in this Data sheet are derived from a variety of sources which the Titanium Information Group believes to be reliable. Because it is not possible to anticipate every use or operating condition, you are urged, if in doubt, to consult with appropriate personnel of the supplier company.