

Tantalum Diaphragm with Platinum Button for Hydrogen Applications

Hydrogen is the most abundant atom in the universe, versatile, low-emission energy carrier that is the path to decarbonizing for many heavy-industry sectors of today.

International Energy Agencies expect the demand for Hydrogen to increase 44% by 2030. Hydrogen produces zero greenhouse gas emissions at its point of use. Uses of Hydrogen are wide varying such as power generation, transportation, and in industries needing high-energy density such as Chemical Production, Steel Plants, Cement Production, Ships, and other Heavy Industries. To operate these plants safely and efficiently, selecting Hydrogen-Friendly Metallurgy for instrumentation is key. If Hydrogen-Friendly Metals are not selected this could cause a catastrophic event but at a minimum will cause a drift in the instrumentation measurement. Hydrogen causes two damaging effects to pressure instruments: Hydrogen Migration and Hydrogen Embrittlement. In many cases, gold plated stainless steel or Hastelloy C276 is all that is needed to protect the instrument from the presence of Hydrogen. In these cases, HAYGOR can offer a wide range of Gold Plating options to assist in these applications.

In extreme process conditions, Tantalum may be the metallurgy of choice due to the formation of a dense highly resistant oxide film on its surface. In high temperature concentrated mineral acids; it is attacked. While some material loss might be acceptable, the electrochemical evolution of hydrogen creates a major issue as hydrides form on the surface.

The hydrides form very brittle areas within the metal structure and therefore cause a loss of mechanical strength which can cause a catastrophic failure of the instrument. At a minimum it will affect the measurement as the hydrogen migrates through the diaphragm material and builds pressure on the other side causing an averaging effect which is seen as drifting in the measurement.

HAYGOR offers a Tantalum Diaphragm with a welded platinum button to protect the tantalum from embrittlement. Even a very small amount of platinum implanted in the surface of tantalum has a significant influence on the embrittlement caused by hydrogen. Implanted platinum reduces hydrogen adsorption electrochemically, it also decreases the entire corrosion process, including the cathodic hydrogen evolution reaction, and is effective for a period in extremely corrosive environments, even though only a shallow layer of tantalum is modified. This enhancement to the HAYGOR line of diaphragm seals for extreme services significantly expands the application of tantalum material, especially in environments where hydrogen is present.

