

## Titanium Alloys for Cryogenic Gas Bottle Applications: A Comparative Study

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**Abstract :** Titanium alloys, owing to their high specific strength coupled with excellent resistance to corrosion in many severe environments, find extensive usage in the aerospace sector. Alpha and beta lean Titanium alloys have an additional characteristic of exhibiting high toughness with an NTS/ UTS ratio greater than one down to liquid oxygen and liquid helium temperatures. The cryogenic stage of high-performance rockets utilizes cryo-fluid submerged pressurizing tanks to improve volume to mass performance factor. A superior volume-to-mass ratio is achieved for LH2-submerged pressurizing tanks as compared to those submerged in LOX. Such high-efficiency tanks for LH2 submerged application necessitate the use of difficult to process alpha type Ti5Al2.5Sn-ELI alloy, which requires close control of process parameters to develop the tanks. In the present paper, a comparison of this alpha-type cryogenic Titanium alloy has been brought out with conventional alpha-beta Ti6Al4V-ELI alloy, which is usable up to LOX temperatures. Specific challenges faced during the development of these cryogenic pressurizing tanks for a launch vehicle based on the author's experience are included in the paper on the comparatively lesser-studied alpha Ti5Al2.5Sn-ELI alloy.

**Keywords :** cryogenic tanks, titanium Alloys, NTS/UTS ratio, alpha and alpha-beta ELI alloys

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