

## **TOT for high strength beta Titanium alloys for aerospace structural sheet application**

### **1. Description of the technology:**

An indigenous development of high strength beta titanium alloys was taken up by DMRL for aircraft structural applications which were funded by ADA, Bangalore. As is known, the high strength beta titanium alloys due to their higher strength, ductility, fatigue and fracture toughness are used for aircraft structural applications and can replace steel and lead to considerable weight saving. Although costly, their lifetime costs are lower due to their superior corrosion resistance as compared to steel. Industrial scale manufacturing technology was established for Ti-15Mo-3Nb-3Al-0.3Fe-0.2Si.

Ti-15Mo-3Nb-3Al-0.3Fe-0.2Si (Beta 21S) is a cold rollable beta titanium alloy for aircraft structural application. The alloy possesses very good oxidation resistance along with good creep resistance almost comparable or better than Ti-6Al-4V which is a alpha+beta titanium alloy and is not very easily cold rollable. Beta 21S can easily be formed into complicated shapes in beta solution treated condition and then can be aged to attain higher strength levels. The full manufacturing technology for raw material selection, alloy melting, thermo-mechanical processing cold rolling, heat treatment, mechanical property evaluation and type certification for cold rolled sheets of 2 mm, 1.2 mm and 0.8 mm in thickness were established with DMRL know-how, processing schedule and hand-holding. The various stages in processing this alloy is given in Figure 1. Therefore the transfer of technology to Midhani has to be completed and this is a step in that direction.

### **2. Application areas:**

The indigenized Beta 21 S (Titan 44) alloy is a cold rollable beta titanium alloy for sheet applications. It has very good oxidation resistance and creep resistance comparable to Ti-6Al-4V but is very amenable to cold rolling. Cold rolled alloy sheets of this alloy can be used to form sheet metal parts of an aircraft, missile system or and engine etc. An example of a formed part is given in Figure 2.

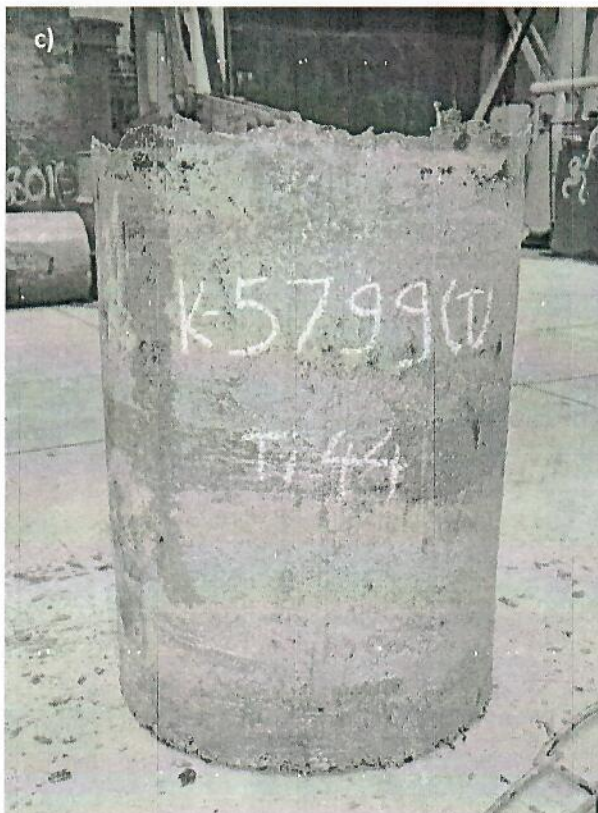


Figure-1 a) 1.4 T electrode prepared by plasma welding of compacts. b) Secondary ingot c) Tertiary ingot

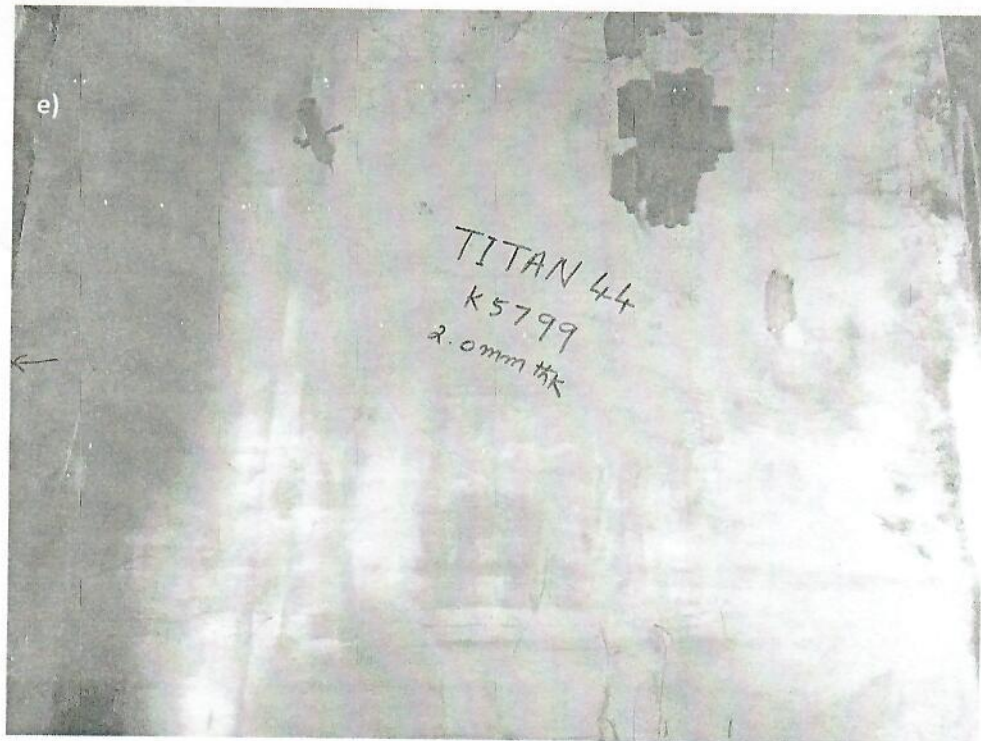
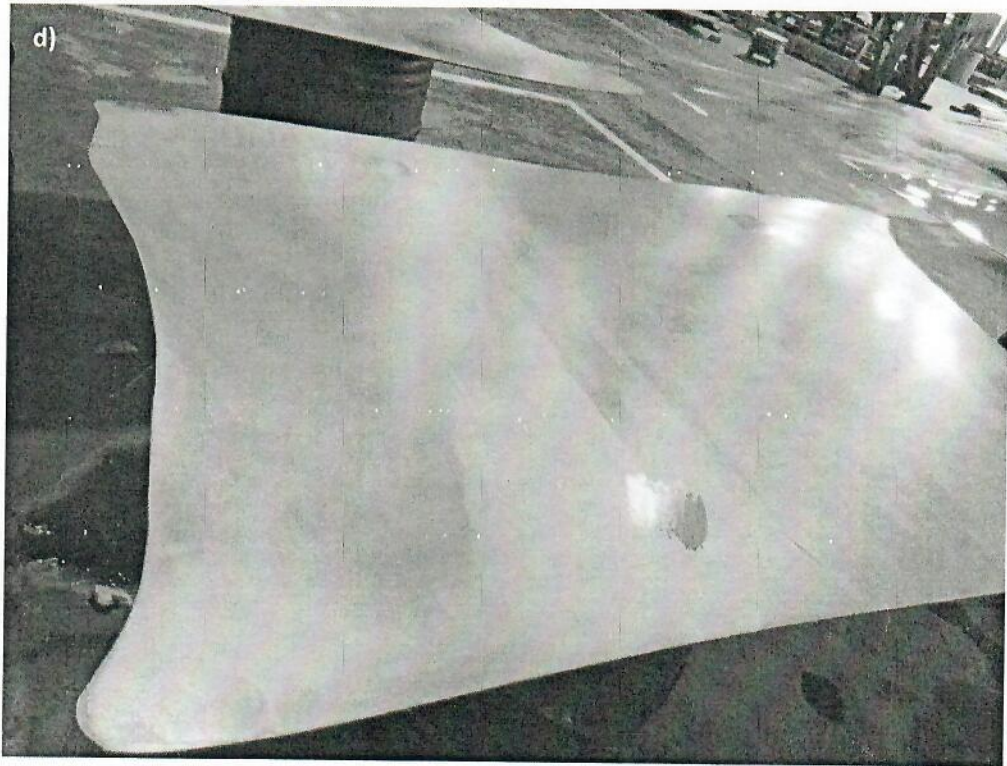


Figure-1 d) Hot rolled 4 mm thick plate e) Cold rolled 2 mm thick sheet



Figure-2 a) Bend sample for determining ductility of cold rolled sheet b) Deep drawn cup to evaluate LDR of the cold rolled sheet

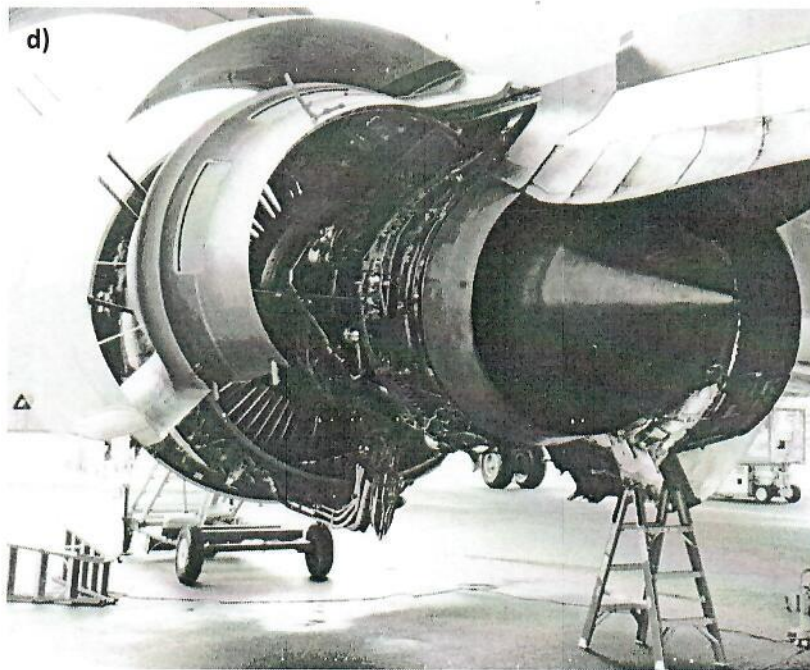
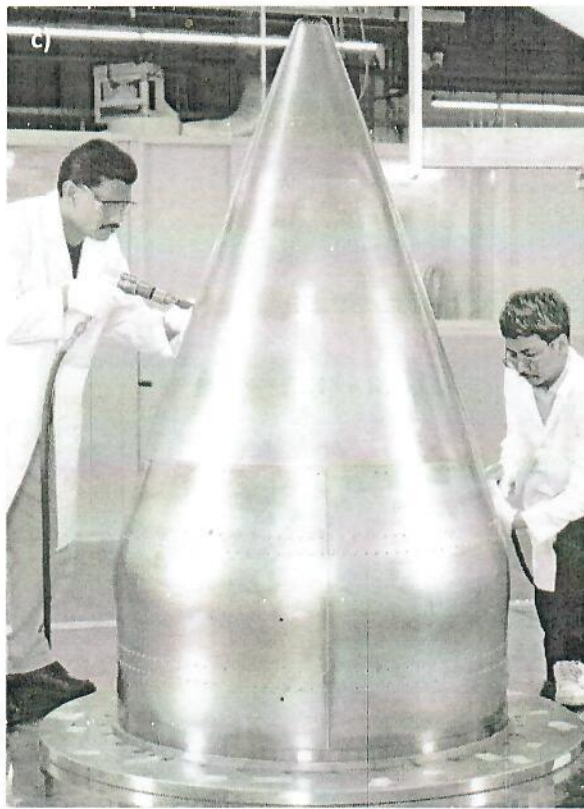


Figure-2 c) Tail plug of engine d) Tail plug assembled in aircraft.(literature)