Low-Cost, Castable Titanium Alloys
High Strength and/or High Ductility

Cast Titanium Alloys - Mechanical Properties (typical)

<table>
<thead>
<tr>
<th></th>
<th>QT-Ti-1A</th>
<th>QT-Ti-2A</th>
<th>QT-Ti-2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average UTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ksi)</td>
<td>151.1</td>
<td>141.2</td>
<td>173.9</td>
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<tr>
<td>Average</td>
<td></td>
<td></td>
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<tr>
<td>Elongation (%)</td>
<td>10.5</td>
<td>13</td>
<td>4.8</td>
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</tbody>
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Materials by Design® Background
QuesTek computationally designed and developed three castable titanium alloys under U.S. Army-funded SBIR Phase I and II programs to incorporate lower-cost raw materials and exhibit greater strength and/or ductility than Ti-6-4.

Description
Three new titanium alloys tentatively named QT-Ti-1A, QT-Ti-2A, and QT-Ti-2B were designed for both performance and economy, by:

i. capturing the benefits of near-net-shape casting for manufacturing;
ii. containing less vanadium than Ti-6-4;
iii. having higher tolerance to oxygen and iron than Ti-6-4; and
iv. being able to use significant amounts of Ti-6-4 scrap as input stock.

QT-Ti-1A (see blue star below) offers ~25 ksi greater UTS and ~2.5% greater elongation than cast Ti-6-4 (i.e. to “QT cast Ti-6-4” which was produced in the same manner as the three new alloys). QT-Ti-1A is expected to be the first of these alloys to be commercialized, and can be considered for example to:

i. replace cast Ti-6-4 to increase a part’s durability or reduce its weight;
ii. replace wrought Ti-6-4 to reduce costs; or
iii. replace Ti-6242 in high-temperature applications to reduce costs.

RT Strength – Elongation Comparison (data from prototype wedge castings)

High Temperature Strength - Elongation Comparison

QT-Ti-1A exhibits higher strength and elongation than Ti-6242 up to 800°F.

Key Design Features

The new alloys utilize a refined, interweaving α/β microstructure which can be achieved at cooling rates representative of conventional commercial processes. This microstructure yields higher strength/toughness characteristics than the parallel α laths found in Ti-6-4.

Material and Licensing Availability

QuesTek is currently seeking initial product applications for QT-Ti-1A, and is also in discussions with potential production/sales licensees.

Please contact QuesTek to obtain custom ingots for use in making initial product applications, or for more information. Patent pending.