



High Performance Metal Solutions

High Performance Solutions for the Aerospace Market



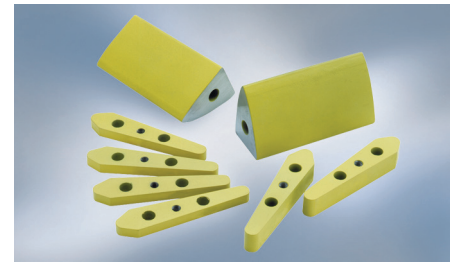
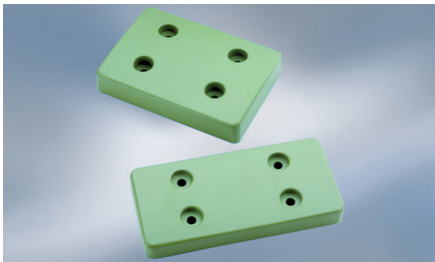
High Performance Metal Solutions

Tungsten Alloys Machined for Aerospace Applications

H.C. Starck Solutions, a worldwide manufacturer of refractory metals and fabricated products, provides high performance solutions to customers in the aviation industry. Refractory metals like tungsten alloys have been the choice material for machined and fabricated products in critical aerospace applications.

Our machineable high-density tungsten alloys, with a density over 60% higher than lead, help stabilize helicopter rotor blades and aircraft wings, winglets, ailerons, elevators, and rudders:

- > **Aircraft and Helicopter Balance Weights**
- > **Instrumentation Balance Weights**
- > **Vibration Dampening**
- > **Produced and Certified to AMS-T-21024, AMS 7725 and ASTM B777**



Customer Collaboration with tighter Process Controls

To meet the rapidly growing demands of the aviation market, H.C. Starck Solutions works closely with its customers in developing and producing custom products per customer specifications. With over 30 years of experience in manufacturing high performance materials for various applications, H.C. Starck Solutions consistently delivers materials and products of exceptional quality.

As a vertically integrated manufacturer, we exercise tight control of all our processes from refining the raw materials to delivering high purity finished products. H.C. Starck Solutions has a unique global reach allowing for close contact and collaboration with our customers. Our experienced Research and Development department allows us to constantly be at the forefront of technological advancement and development of new products together with our partners in the industry.

H.C. STARCK SOLUTIONS SUPPLIES THE FOLLOWING TUNGSTEN ALLOYS:

| Alloy Designation | | K1700 | K1701 | K1750 | K1800 | K1801 | K1850 |
|--------------------------------------|---------------------------------------|---------|---------|---------|---------|---------|---------|
| Tungsten content | (%) | 90 | 90 | 92.5 | 95 | 95 | 97 |
| Density | (g/cm ³) | 17 | 17 | 17.5 | 18 | 18 | 18.5 |
| | (lb/in ³) | 0.61 | 0.61 | 0.63 | 0.65 | 0.65 | 0.67 |
| Hardness | (Rc) | 23 | 22 | 24 | 25 | 24 | 26 |
| Ultimate Tensile Strength | (psi) | 125,000 | 110,000 | 125,000 | 125,000 | 110,000 | 120,000 |
| | (N/mm ²) | 860 | 760 | 860 | 860 | 760 | 830 |
| Yield Strength | (psi) | 85,000 | 80,000 | 90,000 | 90,000 | 85,000 | 95,000 |
| | (N/mm ²) | 590 | 550 | 620 | 620 | 590 | 660 |
| Elongation | (% in 1 inch) | 12 | 4 | 10 | 8 | 2 | 6 |
| Modulus of Elasticity | (psi × 10 ⁶) | 45 | 40 | 46 | 48 | 45 | 50 |
| | (kN/mm ²) | 310 | 280 | 320 | 330 | 310 | 345 |
| Magnetic Properties | | slight | none | slight | slight | none | slight |
| Magnetic Permeability | (μ) | >1.05 | <1.05 | >1.05 | >1.05 | <1.05 | >1.05 |
| Thermal Expansion Coefficient | (×10 ⁻⁶ /°C)(20 °C–500 °C) | 5.1 | 5.4 | 4.9 | 4.8 | 5.0 | 4.8 |
| Thermal Conductivity | (cgs) | 0.20 | 0.23 | 0.24 | 0.27 | 0.32 | 0.26 |
| Electrical Conductivity | (% IACS) | 11 | 14 | 12 | 15 | 16 | 16 |
| MIL-T-21014(D) | class | 1 | 1 | 2 | 3 | 3 | 4 |
| ASTM B777 | class | 1 | 1 | 2 | 3 | 3 | 4 |

Exceeds requirements of the following specifications: MIL-T-21014, ASTM B777 and AMS 7725.

Product Offerings for other Markets

H.C. Starck Solutions supplies high performance materials and alloys including molybdenum (Mo), nickel based (Ni) alloys, tantalum (Ta), niobium (Nb) and tungsten (W) to critical applications in a range of markets:



Aerospace & Defense



Chemical Processing



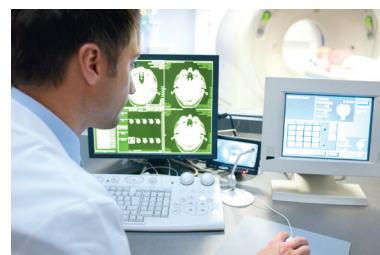
Electronics



Energy



Automotive



Medical

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