



AEROSPACE MATERIAL SPECIFICATION

AMS7023™

Issued

2021-06

Gamma Titanium-Aluminide Powder for Additive Manufacturing
Ti - 48Al - 2Nb - 2Cr

RATIONALE

This SAE Aerospace Material Specification is intended to provide a specification that will allow powder of gamma titanium-aluminide alloy Ti - 48Al - 2Nb - 2Cr to be procured in the aerospace supply chain for use in additive manufacturing.

1. SCOPE

1.1 Form

This specification covers a heat-resistant gamma titanium aluminide alloy in the form of pre-alloyed powder.

1.2 Application

This powder is intended to be used for additive manufacturing of lightweight aerospace parts requiring high strength and creep resistance up to 1500 °F (815 °C).

1.3 Classification

Class A: Particle size distribution: 45 to 150 µm powder

Class B: Particle size distribution: 15 to 53 µm powder

1.4 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards that may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order form a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2021 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE AMS7023

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS7023/>

Documents
Document Sharing Hub

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS7002 Process Requirements for Production of Metal Powder Feedstock for Use in Additive Manufacturing of Aerospace Parts

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B212 Apparent Density of Free-Flowing Metal Powders Using the Hall Flowmeter

ASTM B213 Flow Rate of Metal Powders Using the Hall Flowmeter

ASTM B214 Sieve Analysis of Granular Metal Powders

ASTM B243 Standard Terminology of Powder Metallurgy

ASTM B417 Standard Test Method for Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel

ASTM B822 Particle Size Determination of Metal Powders by Light Scattering

ASTM B923 Standard Test Method for Metal Powder Skeletal Density by He or Nitrogen Pycnometry

ASTM B964 Flow Rate of Metal Powder Using the Carney Funnel

ASTM B703 Standard Test Method for Apparent Density of Metal Powders and Related Compounds Using the Arnold Meter

ASTM E539 Standard Test Method for Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry

ASTM E1409 Standard Test Method for Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by Inert Gas Fusion

ASTM E1941 Determination of Carbon in Refractory and Reactive Metals and Their Alloys by Combustion Analysis

ASTM E1447 Standard Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by Inert Gas Fusion Thermal Conductivity/Infrared Detection Method

ASTM E2371 Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Atomic Emission Spectrometry

ASTM E2994 Standard Test Method for Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry (Performance-Based Method)

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by chemical analysis in accordance with ASTM E539, ASTM E2371, ASTM E2994, or by other analytical methods acceptable to the purchaser (see 3.1.2, 8.10.1). Carbon content shall be determined by ASTM E1941, oxygen, and nitrogen content shall be determined by ASTM E1409, and hydrogen content shall be determined by ASTM E1447.

Table 1 - Composition [wt.%]

	Min	Max
Aluminum, Al	33.0	36.0
Chromium, Cr	2.2	3.0
Niobium, Nb	4.4	5.2
Oxygen, O	-	0.15
Nitrogen, N	-	0.050
Carbon, C	-	0.025
Hydrogen, H	-	0.005
Iron, Fe	-	0.20
Other Elements, each (3.1.1, 8.10.2)	-	0.05
Other Elements, total (3.1.1, 8.10.2)	-	0.40
Titanium, Ti	-	remainder

3.1.1 Determination not required for routine acceptance with the exception of B, Co, Cu, Mn, Mo, Ni, Si, Sn, V, W, Y, and Zr, which shall be measured but reported collectively, with any other measured elements, as "Other Elements, total."

3.1.2 If using ASTM E2371, the test laboratory must have procedures for diluting samples for high concentration elements.

3.1.3 Check analysis, composition variations shall meet the applicable requirements of AMS2249.

3.2 Powder Production

Powder shall be manufactured in accordance with AMS7002, with the additional requirements defined in 3.2.1.

3.2.1 Melting

Metal shall be melted in an enclosed vessel under vacuum, argon, or helium gas atmosphere. An argon, or helium gas backfill after pulling vacuum is permissible. Air melting under a cover gas is not permitted. Argon and/or helium gas (see 8.12) shall be used for metal atomization or powder spheroidization.

3.2.2 Powder Heats and Lots

Powder heats and lots definitions shall be in accordance with AMS7002.

3.3 Particle Size

3.3.1 Particle Size Distribution (PSD)

The powder particle size distribution shall be tested according to ASTM B214 or ASTM B822. ASTM B214 shall be used to measure powder particle sizes 45 µm (325 mesh) and greater. ASTM B822 shall be used for powder particle sizes less than 45 µm (325 mesh). Unless otherwise specified, the powder particle size distribution for each class of powder shall satisfy the requirements shown in Table 2. Powder particle size distributions that differ from the distribution provided in Table 2 and measurement methods that do not comply with ASTM B214 and B822 shall be agreed upon between purchaser and producer.