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Vesoljska tehnika - Priročnik o strukturnih materialih - 8. del: Slovar

Space engineering - Structural materials handbook - Part 8: Glossary

Raumfahrttechnik - Handbuch der Konstruktionswerkstoffe - Teil 8: Glossar

Ingénierie spatiale - Manuel des matériaux structuraux - Partie 8 : Glossaire

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Space engineering - Structural materials handbook - Part 8: Glossary

Ingénierie spatiale - Manuel des matériaux structuraux - Partie 8 : Glossaire

Raumfahrttechnik - Handbuch der Konstruktionswerkstoffe - Teil 8: Glossar

This draft Technical Report is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

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European Foreword

This document (FprCEN/TR 17603-32-08:2021) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16603-32.

This Technical report (FprCEN/TR 17603-32-08:2021) originates from ECSS-E-HB-32-20 Part 8A.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any TR covering the same scope but with a wider domain of applicability (e.g.: aerospace).

This document is currently submitted to the CEN CONSULTATION.

Introduction

The Structural materials handbook is published in 8 Parts.

A glossary of terms, definitions and abbreviated terms for these handbooks is contained in Part 8.

The parts are as follows:

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1 Glossary

A

A

Aluminium Association, USA

A-BASIS DESIGN ALLOWABLE

A value which at least 99% of the population of values is expected to fall with a confidence of 95%, Ref. [9]; also known as 'A' value and 'A' basis.

A-SCAN

A single point signal describing the ultrasonic response of material immediately beneath the transducer

A-stage

An early stage in the polymerisation reaction of certain thermo-setting resins (especially phenolic) in which the material, after application to the reinforcement, is still soluble in some liquids and is fusible; sometimes called resole. [See also: B STAGE, C STAGE]

'A' value

An 'A' value is one above which at least 99% of the population of values is expected to fall with a confidence of 95%. [See also: ALLOWABLES]

ABLATIVE

Sacrificial material which protects a structure from high-velocity, high-temperature gas streams. It is typically used on leading surfaces for planetary re-entry to protect against frictional atmospheric heating. The surface of the ablative is consumed by reaction, abrasion and evaporation or sublimation and the lost material carries heat away from the underlying structure

AblaDor DO-31-F

Lightweight phenolic ablative

ABM

Apogee Boost Motor

ABS

1 Alumino-boro-silicate ceramic

2 Acrylonitrile-butadiene-styrene copolymer

ACC

Advanced Carbon-Carbon (NASA) replaced RCC

ACCELERATOR

A material mixed with a catalysed resin to increase the rate of chemical reaction between the catalyst and resin, used in polymerising resins, also known as promoter or curing agent

ACCELEROMETER

A device for measuring acceleration, often used in vibration analysis

ACCEPTANCE

Verification phase with the objective to demonstrate that the flight items are free of workmanship defects and integration errors and ready for operational use, Ref. [1]

ACESA

Advanced composites with embedded sensors and actuator. An American smart technology programme.

ACG

Advanced Composites Group, UK

ACK analysis

Aveston-Cooper-Kelly analysis for modelling the onset of matrix cracking in composite materials (with particular regard to CMC ceramic matrix composites)

ACOUSTIC EMISSION (AE)

An inspection technique where the sound generated by damage formation and propagation (under test stressing or in-service) is monitored using sensitive, high-frequency microphones. Triangulation techniques can be used to locate the damage events within a three dimensional structure. Frequently used to measure the integrity of composite laminates

ACRV

Assured Crew Return Vehicle (NASA/ESA) for emergency return of astronauts from orbiting space stations to earth

ACS

Attitude Control System

ACTEX

Advanced control technology experiment. An American smart technology programme.

ACTIVE COMPENSATION

A device able to change its characteristics in response to an externally triggered signal, e.g. stiffness in response to vibration

ACUSIL I

An ablative foam composed of silicone resin, quartz microballoons, phenolic microballoons and quartz fibre

ACUSIL II

Lower density ablative foam composed of silicone resin, quartz microballoons, phenolic microballoons and quartz fibre. Remains RF transparent during re-entry

ADHEREND

Plate adhesively bonded to another plate, Ref. [10].

ADHESION

The state in which two surfaces are held together at an interface by forces or the interlocking action of an adhesive or both

ADHESIVE

A substance capable of holding two surfaces together

ADVANCED COMPOSITES

Composite materials with structural properties comparable to or better than those of aluminium; e.g. boron, graphite and aramid composites

AE

See: Acoustic Emission

AECMA

Association Européen des Constructeurs Matériel Aérospatiale; European Association of Aerospace Industries

AEFIS

Acoustic emission flight instrumentation system. A structural health monitoring system, developed by Boeing.

Aerotiss® 2.5D

Aerospatiale reinforced carbon-carbon (RCC) material with multidirectional fibre architecture

A_f

Austenite finish temperature

AFNOR

Association Français de Normalisation; French national standards organisation

AFRSI

Advanced Flexible Reusable Surface Insulation (Shuttle orbiter)

AFWAL

Air Force Wright Aeronautical Laboratory, USA

AGC

Attitude Gain Control

AGE HARDENING

A thermal treatment used to improve the strength of some metal alloys, e.g. certain aluminium alloys, [See also: Precipitation Hardening].

AGED STRUCTURE

A structure which can have structural degradation or damage as a result of being exposed to the combined effects of the environment

AGEING

General: The process or the effect on materials of exposure to an environment (elevated temperature, ultraviolet radiation, moisture or other hostile environment) for a period of time; also known as 'aging'

1 Material or sample: usually undertaken before testing and applied to simulate the expected service environmental conditions, e.g. exposure to heat and humidity

2 Structure: the progressive change in characteristics owing to exposure to the service conditions, e.g. corrosion, outgassing

3 Processing: a thermal process used to obtain the desired microstructure and properties of metal alloys, e.g. some aluminium alloys

AGGRESSIVE ENVIRONMENT

Any combination of liquid or gaseous media and temperature that alters static or fatigue crack-growth characteristics from 'normal' behaviour associated with an ambient temperature and laboratory air environment, Ref. [5]

AGING

[See: Ageing].

AI

Artificial intelligence

AIAA

American Institute of Astronautics and Aeronautics, USA

AISI

American Iron and Steel Institute

AIT

Assembly, Integration and Test

AIV

Assembly, Integration and Verification

AKM
Apogee Kick Motor

ALFLEX
Automatic Landing Experimental Vehicle

Al-Li
Aluminium-lithium alloy

ALLOTROPY
Existence of a chemical element in two or more physical forms, e.g. carbon as graphite or diamond

ALLOWABLE LOAD
The load that induces the allowable stress in a material, Ref. [5]

ALLOWABLE STRESS
The maximum stress that can be permitted in a material for a given operating environment to prevent rupture, collapse, detrimental deformation or unacceptable crack growth, Ref. [5]

ALLOWABLES
Material values that are determined from test data at the laminate or lamina level on a probability basis (e.g. 'A' or 'B' values), following ASTM or other test standards accepted by the final customer. [See also: A-BASIS DESIGN ALLOWABLE; B-BASIS DESIGN ALLOWABLE; 'A' VALUE, 'B' VALUE]

ALLOY
Mixture of a base metallic element with one or more other metallic or non-metallic elements

AlN
Aluminium nitride

ALS051
Medium-density, silicone-based ablative

ALSCAP
Alternative Low-cost, Short Manufacturing Cycle Assessment Programme

ALUMINA
Aluminium Oxide, Al2O3.

ALUMINIDE
Intermetallic compound of another metallic element, or elements, with aluminium, e.g. NiAl, TiAl or FeAl

ALUMINIUM (Al)
Metallic element, melting point 660°C, density 2700 kg m^{-3}. Uses: ubiquitous aerospace alloy base, important component in oxidation resistant alloys and coatings and as part of basic strengthening mechanism for nickel-based superalloys

ALUMINIUM-LITHIUM
An aluminium alloy containing typically between 1% and 3% Li, with the objective of increasing mechanical properties over base alloy alone.

Note: Because Li is a low-level alloy addition, Al-Li alloys are classified within the 2XXX, 7XXX and 8XXX wrought alloy designations, plus 2XX casting alloys

ALUMINIUM NITRIDE (AlN)
Ceramic with high thermal conductivity (140 W/mK to 177 W/mK), but is effectively an electrical insulator (volume resistivity 1010 ohm cm). Can suffer surface oxidation above 700°C, density 3320 kg m^{-3}.

ALUMINO-SILICATE

Compound of aluminium and silicon oxides used in ceramics and some types of glasses for composite matrix materials

AMBIENT

1 The surrounding environmental conditions, e.g. pressure, temperature or relative humidity

2 usual work place temperature and humidity environmental conditions, e.g. room temperature

ANALYSIS

A verification method performing theoretical or empirical analysis by accepted analytical methods. The selected techniques can typically include systematics, statistics, qualitative design analysis, modelling and computer simulation, Ref. [1]

ANALYSIS PROCEDURE

This document lists all the requirements to be verified by Analysis, grouping them in categories detailing the Verification Plan activity sheets, with planning of the execution and a definition of the associated procedures, Ref. [1]

ANALYSIS REPORT

A document that describes, for each analysis, assumptions, utilised methods, software and results and contains proper evidence that the relevant requirements are satisfied, Ref.[1]

ANALYTICAL LIFE

Life evaluated analytically, i.e. by crack-growth analysis or fatigue analysis, Ref. [5]

ANALYTICAL MODEL

A representation of an item based on mathematical modelling. The modelling is performed on the basis of known mathematical techniques, providing a representation of the item features under investigation, Ref. [1]

ANGLE INTERLOCKED

A triaxial fabric in which all reinforcement fibres are woven at the same time; also known as 'integrally woven'

ANGLE-PLY LAMINATE

Possessing equal plies with positive and negative angles. This bidirectional laminate is simple because it is orthotropic

ANISOTROPIC

Having mechanical or physical properties which vary in direction relative to natural reference axes in the material

ANNEALING

A heat treatment process:

1 Metals: used to reduce residual stresses.

2 Composites: ineffective at reducing residual stresses

ANOXIC

The resistance of a material to thermo-oxidative attack by atomic oxygen

ANTISYMMETRY

Special symmetry with sign change between off-diagonal components, e.g. an unsymmetrical angle-ply laminate

AO

Atomic oxygen; experiments conducted on the Long Duration Exposure Facility (LDEF)

AOCS

Attitude and Orbit Control System, or subsystem

APC

Aromatic polymer composite

AQUEOUS CORROSION
Corrosion by ionic species in water, e.g. chlorides, hydroxides. Includes moisture or humidity trapped or condensed within structures.

AR
Acceptance Review

ARA
Advanced rigid array; a type of ultrasonic transducer assembly

ARALDITE™
A range of epoxy-based structural adhesives; developed by Ciba Geigy, now Vantico

ARALL™
Aramid fibre-reinforced aluminium laminate. [See: FIBRE METAL LAMINATE]

ARAMID
A type of highly oriented aromatic polymer material. Used primarily as a high-strength reinforcing fibre, of which Kevlar™ 49 and Twaron™ HM are most commonly used in aerospace applications

ARAMID/EPOXY
A composite material comprising of an aramid fibre reinforcement in an epoxy matrix

ARC
Austrian Research Centre, Seibersdorf

ARD
Atmospheric Re-entry Demonstrator

AREAL WEIGHT
A measurement of the weight per unit area of a fabric or fabric prepreg; expressed as g/m²

ARIANE
Family of European launch vehicles

ARP
Aramid fibre-reinforced plastic, Ref. [10]

ARTIFICIAL INTELLIGENCE (AI)
The property of a machine capable of reason by which it can learn functions normally associated with human intelligence

A_s
Austenite start temperature

ASIFS
Aerial spacecraft interface structure; part of SILEX

ASIP
Aircraft Structural Integrity Program

ASME
American Society of Mechanical Engineers

ASSEMBLED ARTICLE
Any component 'black box' or assembly of components which represents the article to be used in a spacecraft, Ref. [7].

ASSEMBLY
An accumulation of subassemblies and/or equipment that performs specific functions within a subsystem, e.g. water pump package. (Verification level typical of US standard), Ref.[1]

ASTM

American Society for Testing and Materials; USA standards organisation

ASTP

Advanced Systems and Technology Programme; ESA programme

ASTREX

Advanced space structure technology research experiments; an American smart technology programme

ATC

1 Active Thermal Control

2 Advanced Technical Ceramic

ATOMISATION

Spray technique for producing metal alloy powders with or without a particulate reinforcement. Molten metal is forced through a nozzle into a stream of high-velocity, inert gas. The semi-solid droplets are collected on a substrate. Proprietary processes are OSPREY (un-reinforced alloys) and COSPRAY (particulate reinforced alloys)

ATOX

Atomic Oxygen

AUTOCLAVE

A closed vessel for conducting a chemical reaction or other operation under pressure and heat

AUTOCLAVE MOULDING

After composite lay-up, the entire assembly is placed in steam autoclave at 7 bar to 14 bar and 180°C; additional pressure achieves higher reinforcement loading and improved removal of air

AVCO 5026-39 HCG

Epoxy-novalac, glass fibre honeycomb reinforced material

AVERAGE STRESS CRITERION

A failure criterion in which it is assumed that failure occurs when the average stress over some distance equals the unnotched laminate strength

AWG

American Wire Gauge

AXIAL WINDING

In filament-wound reinforced plastics, a winding with the filaments parallel to the axis

AXISYMMETRY

Symmetry about an axis (in the case of a laminated material it is isotropic in the plane normal to the axis, and this material is called transversely isotropic)

B

B-BASIS DESIGN ALLOWABLE

A value which at least 90 % of the population of values is expected to fall with a confi-dence of 95 %, Ref. [9]; also known as ‘B’ value

B-SCAN

A scanned line response showing features at identifiable depths; nondestructive testing

B-STAGE

An intermediate stage in the reaction of certain thermosetting resins, Ref. [10], in which the material swells when in contact with certain liquids and softens when heated, but cannot dissolve or fuse entirely; sometimes referred to as ‘resistol’. The resin in an uncured prepreg or premix is usually in this stage. [See also: A-STAGE, C-STAGE]

'B' VALUE

A 'B' value is that above which at least 90% of the population of values is expected to fall with a confidence of 95%. [See also: ALLOWABLES]

BACKING SHEET

A thin polymer sheet used to protect prepreg and film adhesive surfaces from contamination and damage prior to use. These have to be completely removed during lay-up and are usually coloured to aid this.

BAe

British Aerospace, UK

BAGGING

Process: the enclosing of an uncured composite lay-up in a heat-resistant bag prior removal of the air and subsequent curing

BAKEOUT

Activity of increasing the temperature of hardware to accelerate its outgassing rates with the intent of reducing the content of molecular contaminants within the hardware. Note: Bakeout is usually performed in a vacuum environment but may be done in a controlled atmosphere, Ref. [8].

BALANCED DESIGN

In filament-wound reinforced plastics, a winding pattern so designed that the stresses in all filaments are equal

BALANCED LAMINATE

Where plies with positive angles are balanced by equal plies with negative angles. While angle-ply laminates have only one pair of matched angles, balanced laminates can have many pairs, plus 0 and 90 degrees. A balanced laminate is orthotropic in in-plane behaviour, but anisotropic in flexural behaviour.

BAM

Bundesanstalt für Materialforschung und prüfung, Federal Institute for Materials Research and Testing, Germany

BATCH

Materials produced during a unique sequence:

1. Fibre: The amount which is produced by the conversion of a number of precursor tows under standard, controlled, processing-plant conditions in one continuous operation, including any surface treatment and sizing of the fibre

2. Prepreg: A quantity, irrespective of width, that is produced under 'no-change conditions' in one continuous operation of the impregnating plant from one batch of resin mix and one batch of fibre. A batch is expected to conform to a fixed manufacturing process and to have homogeneous properties within prescribed tolerances over its whole width and length. A maximum allowable length for a prepreg batch is sometimes specified

3. Resin: A quantity of resin in either film or liquid form produced from one mix of resins, resin modifiers and curing agents

BERYLLIUM (Be)

Metallic element, melting point 1289°C, density 1850 kg m^{-3}. Uses: aerospace structural material, with good dimensional stability and moderately high service temperatures.

BIAS

A type of weave for a fabric, [See: BIAS WEAVE]

BIAS WEAVE

The weft picks cross the warp ends at 45° or 60° instead of the normal 90°.

BIAXIAL WINDING

In filament winding, a type of winding in which the helical band is laid in sequence, side by side, with no crossover of fibres

BIDIRECTIONAL LAMINATE

A reinforced plastic laminate with the fibres oriented in two directions in the plane of the laminate; a cross laminate. [See also: UNIDIRECTIONAL LAMINATE]

BIG FOOT™

Types of mechanical fasteners that provide a larger footprint, i.e. contact area, than conventional types of fasteners; developed by Monogram

BIOMIMETICS

Synthetic materials which function like natural ones, e.g. artificial tendons and Velcro™

BIOPAN

A multi-user exposure facility, designed for exobiology, radiation biology, radiation dosimetry and material science investigations in space; ESA mission

BIPROPELLANT

Rocket fuel consisting of two chemical components which react on contact in the combustion chamber, e.g. mono-methyl-hydrazine (MMH) and nitrogen tetroxide (NTO)

BISFA

International Bureau for Standardisation of Man-made Fibres

BISMALEIMIDE (BMI)

A type of polyimide that cures by an addition rather than a condensation reaction, thus avoiding problems with volatiles, and which is produced by a vinyl-type polymerisation of a polymer terminated with two maleimide groups. It has intermediate temperature capability between epoxy and polyimide (about 200°C)

BLEED

The removal of excess resin from a prepreg during processing. [See also: CONTROLLED BLEED and ZERO-BLEED]

BLEEDER CLOTH

Non-structural, fibre glass cloth placed adjacent to the composite material part to absorb excess resin during cure, and removed from the part after cure

BLIND

Fasteners: Installed from one side of a component only

BLISK

Turbine disk where the blades and hub are formed as a single piece (Integrally-bladed disk).

BLISTER

Delamination in a distinct local area or areas

BLOX

Laser enhanced oxidation test facility at ONERA, France.

BMI

Bismaleimide. [See: BISMALEIMIDE]

BOND LINE

The area between two materials that have been adhesively bonded; includes the layer of adhesive between the adherends

BOND STRENGTH

The amount of adhesion between bonded surfaces; a measure of the stress required to separate a layer of material from the base to which it is bonded. [See also: PEEL STRENGTH]

BONDED JOINT

The general area of contact for a bonded structure. This includes composite to composite and composite to metal adherends and all forms of adhesives including co- and post-cured joints. [See also: ADHEREND, ADHESIVE, CO-CURE, POSTCURE]