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Part 5: New advanced materials, advanced metallic materials,
general design aspects and load transfer and design of joints

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European Foreword

This document (CEN/TR 17603-32-05:2022) 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 (CEN/TR 17603-32-05:2022) originates from ECSS-E-HB-32-20 Part 5A.

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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).

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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| TR 17603-32-01 | Part 1 | Overview and material properties and applications | Clauses 1 - 9 |
| TR 17603-32-02 | Part 2 | Design calculation methods and general design aspects | Clauses 10 - 22 |
| TR 17603-32-03 | Part 3 | Load transfer and design of joints and design of structures | Clauses 23 - 32 |
| TR 17603-32-04 | Part 4 | Integrity control, verification guidelines and manufacturing | Clauses 33 - 45 |
| TR 17603-32-05 | Part 5 | New advanced materials, advanced metallic materials, general design aspects and load transfer and design of joints | Clauses 46 - 63 |
| TR 17603-32-06 | Part 6 | Fracture and material modelling, case studies and design and integrity control and inspection | Clauses 64 - 81 |
| TR 17603-32-07 | Part 7 | Thermal and environmental integrity, manufacturing aspects, in-orbit and health monitoring, soft materials, hybrid materials and nanotechnologies | Clauses 82 - 107 |
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46 Aluminium alloys and their composites

46.1 Introduction

46.1.1 General

[Aluminium](#) alloys are established in aerospace, with many years of application and service experience.

Alloy developments are described that have aimed at improving the mechanical characteristics of basic aluminium alloys and the limitations on service temperature.

The ability to improve dimensional stability by combining alloys with low [CTE](#) materials is an advantage for space use.

The materials described are divided into the main groups:

- Conventional aluminium alloys.
- New aluminium alloys.
- MMC – metal matrix composites.
- FML – fibre metal laminates

46.1.2 Conventional aluminium alloys

In recent years it has become clear that many of the problems associated with conventional aluminium alloys, e.g. inconsistent fracture properties, were associated with the nature, size, morphology and distribution of intermetallic particles, both intended (as the strengthening phase) and unintended (from tramp elements). Attention has therefore focussed on improving both alloy chemistry and process technology to give more desirable structures in the finished material. In addition to alloy modifications, this has resulted in the introduction of modified thermo-mechanical treatments (combinations of heat treatments and hot or cold working) with new temper designations, which are expansions of the basic tempers, [See: [46.2](#)].

Specific data on conventional aluminium alloys are not given in this handbook, [See: MMPDS-01 and PMP], Ref. [\[46-71\]](#), [\[46-72\]](#).

46.1.3 New aluminium alloys

These can be grouped as:

- Aluminium-[lithium](#) (Al-Li) alloys. [See: [46.4](#)]
- [Powder metallurgy](#) (P/M) alloys: