Aluminum lightens the world
アルミでかなえる、軽やかな世界

Business briefing on the Aerospace and Defense Materials Business

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Aerospace and Defense Materials Business Division

Today’s Agenda

01. Establishment and Background

02. Business: Domains Served

03. Aluminum Alloys Used in Aerospace and Defense

04. About Forging

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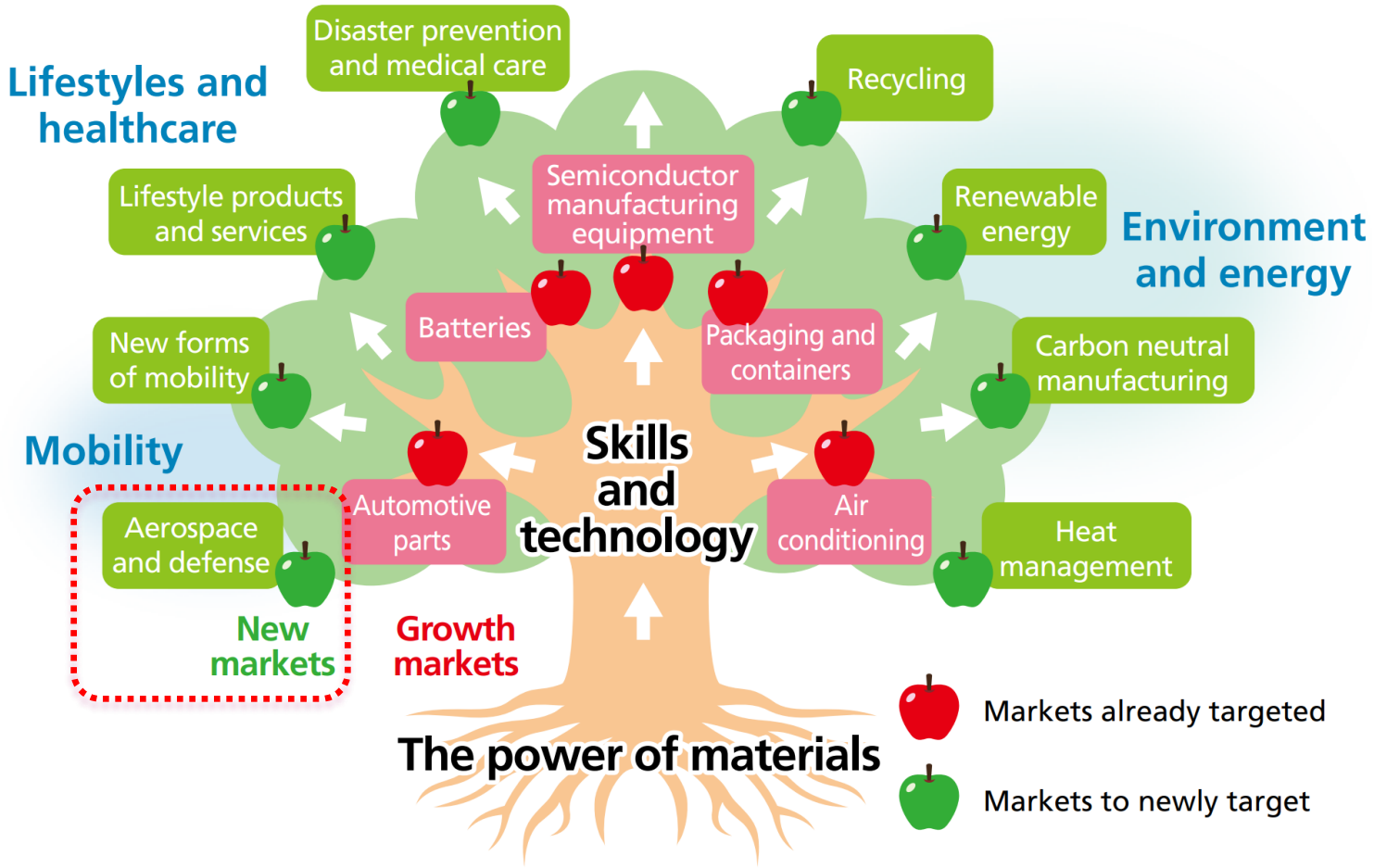
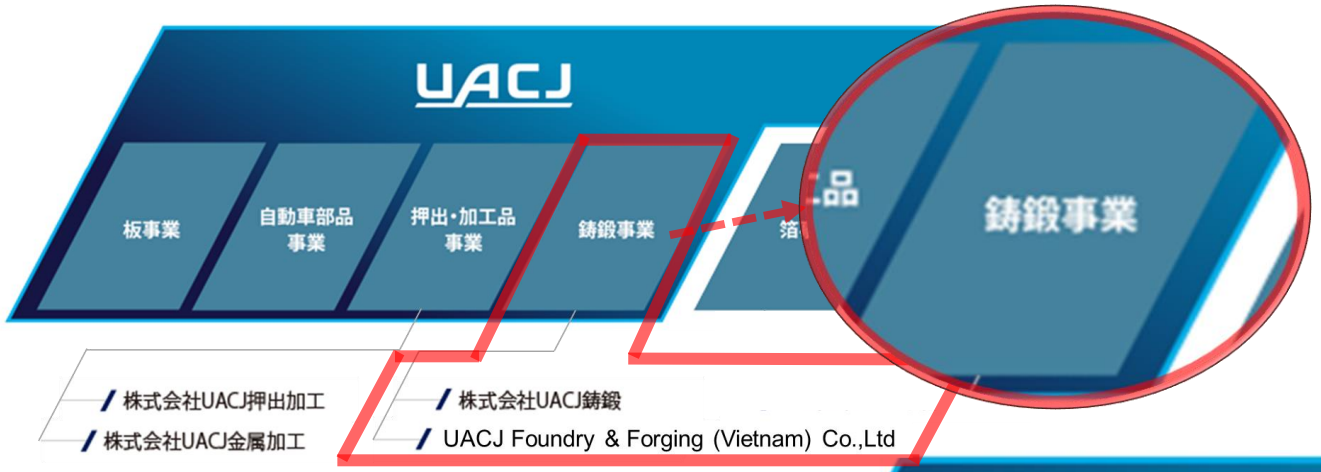
Establishment and Background of the Aerospace and Defense Materials Business Division

UACJ VISION 2030

Venturing into aerospace and defense materials → Expanding sales into new domains



Establishment and Background of the Aerospace and Defense Materials Business Division



Reorganization on October 1, 2024

Business supporting aerospace/defense

Plates | **Extruded products** | **Forged products** | **Castings** | **Processed/ machined products**

Aerospace and Defense Materials Business Division

Organization providing one-stop service

Aims of the New Business Division

Aerospace and defense materials	● **Domain with solid growth potential** ● **Requests from customers** **— domestic prime customers**

An organization established in line with customer needs

Enhancing supply chain resilience

Aviation

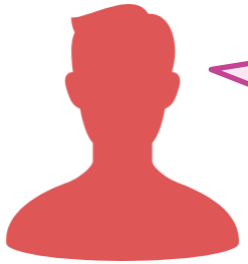
Airframe structures
Engine parts, etc.

Aerospace

Rocket structures
Fuel tank parts, etc.

Defense

Defense aircraft
Special vehicles, etc.



Customer feedback after the division was established

- We appreciate the clear indication of applications and purposes.
- It's convenient to have a one-stop solution for all aluminum applications.

Establishment and Background of the Aerospace and Defense Materials Business Division

: Products from Aerospace and Defense Materials Business Division

Melting

Casting

Flat rolling

Extrusion

Forging

Casting

Flat rolled products

Extruded products

Forged products

Cast products

Foil products

Processed products

The Aerospace and Defense Materials Business Division handles a wide range of products, including plates, extruded products, forged products, cast products, and processed products.

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Domains Served

Aviation

Aerospace

Defense

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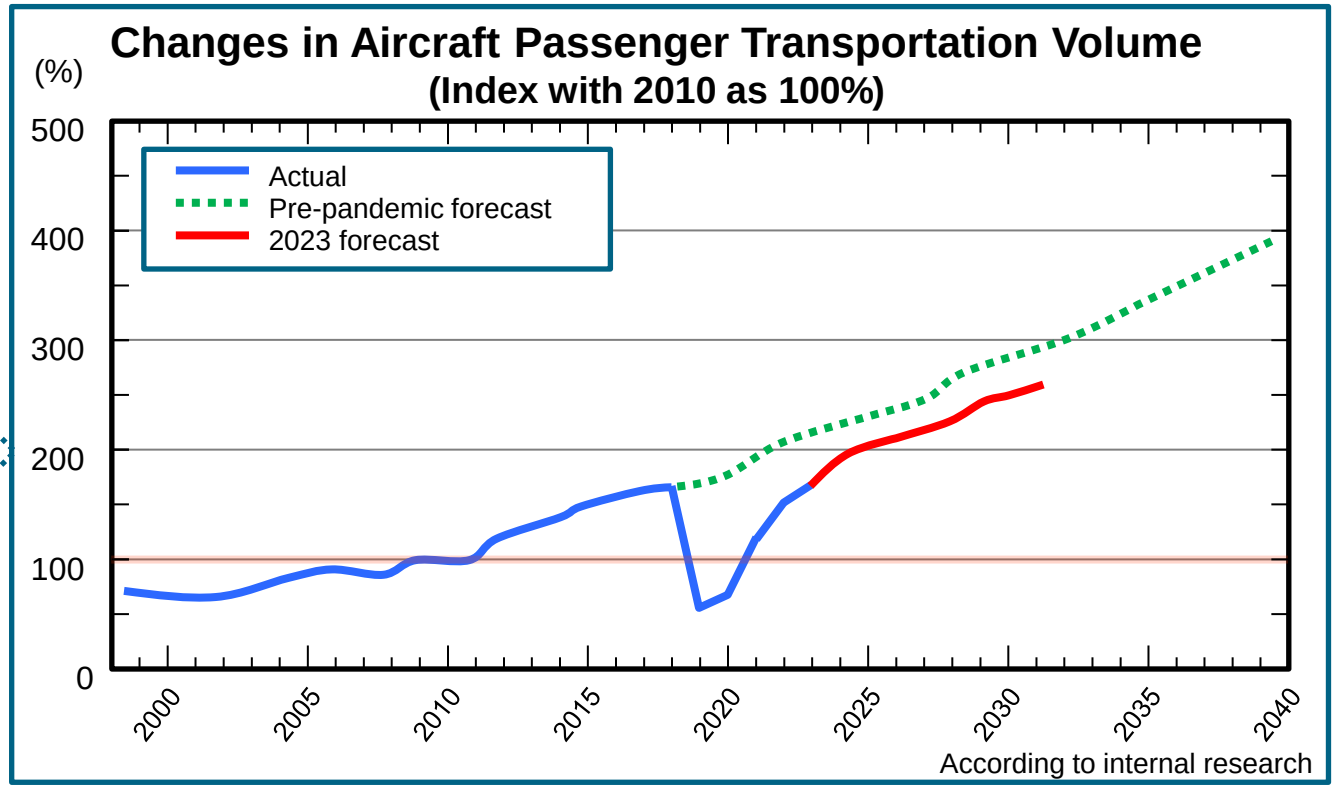
Aviation Demand

Aircraft: Requirement to replace with new models

- ✓ Measures to reduce GHG emissions and other environmental burdens
  ⇒ Needs for greater fuel efficiency
- ✓ Passenger demand for more seats due to increased passenger volume
- ✓ Renewal of aging and obsolete aircraft



Continued growth is projected for the aviation industry

UACJ's Aviation Market Share (Domestic)

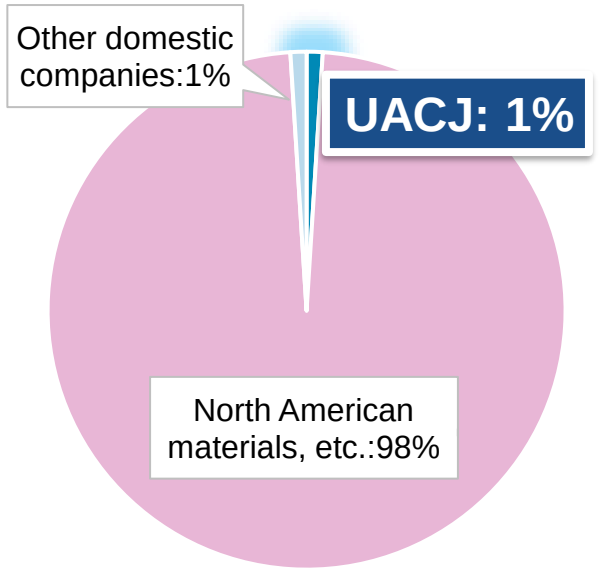
Aiming to stabilize the domestic supply chain by switching from North American materials

Aircraft aluminum products → Expand market share for all products

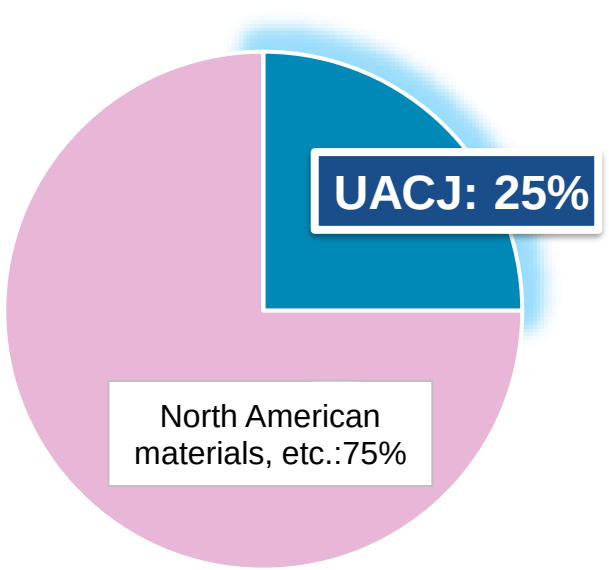
Share among domestic prime manufacturers

According to internal research at 2023

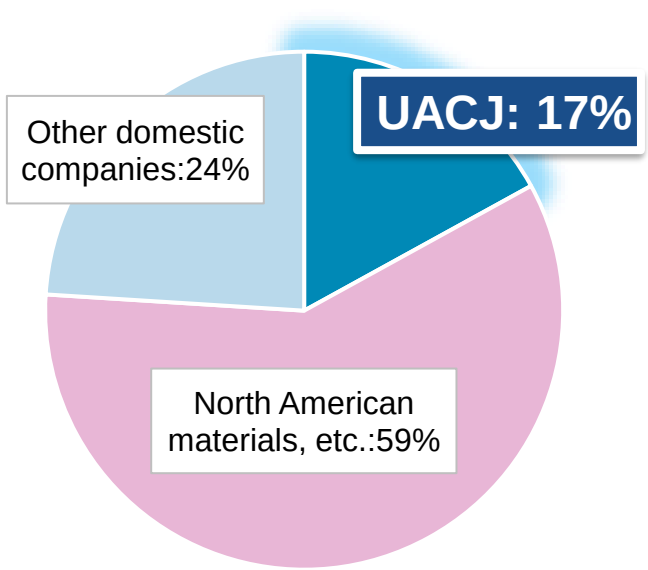
Plates



Extruded products



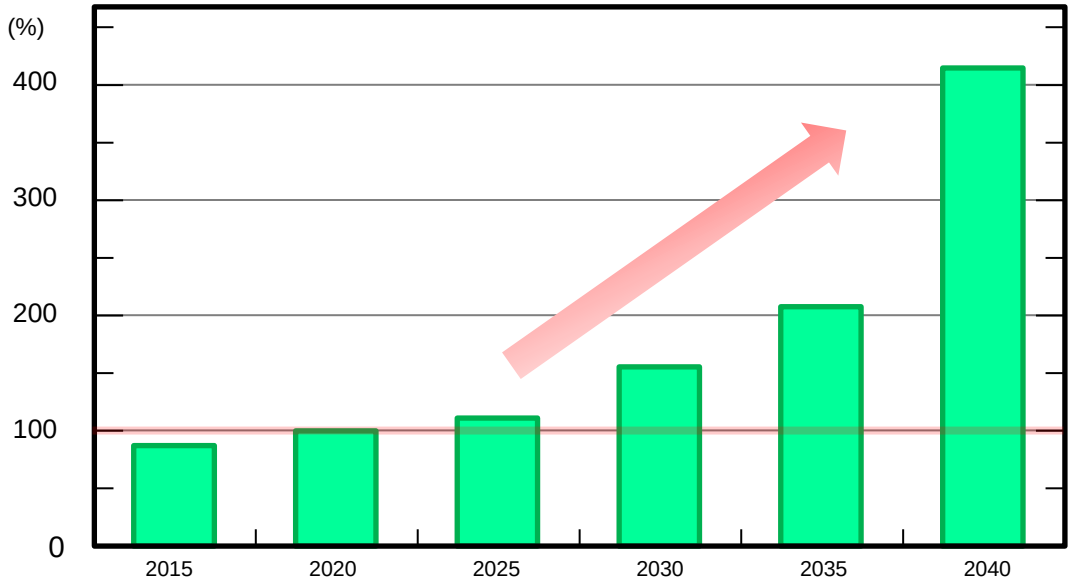
Forged products



Aerospace Demand

Scale of the global aerospace industry

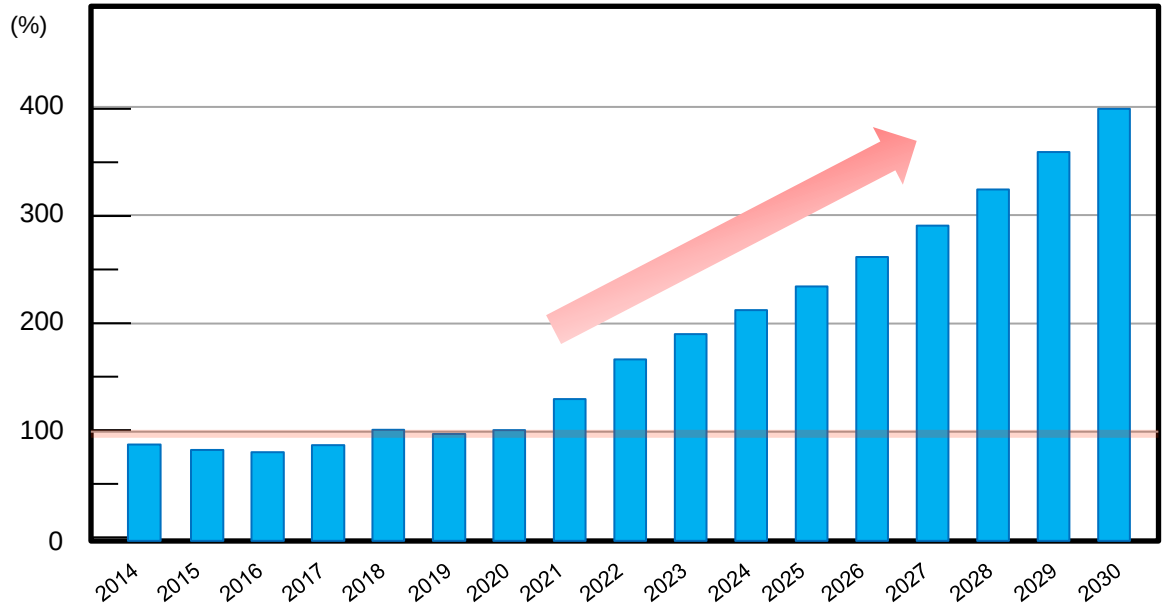
(2020 = 100%)



According to internal research

Number of rocket launches

(2020 = 100%)



According to internal research

Context to aerospace industry growth

- Individual position measurement:
  Autonomous driving and motion measurement
- Global environment measurement:
  Global warming countermeasures and agricultural applications
- Communication from satellite orbit:
  Data communication and military applications

Increased need for satellites

Increase in number of rocket launches

Expanding market scale for rockets

UACJ's Aerospace Market Share (Domestic)

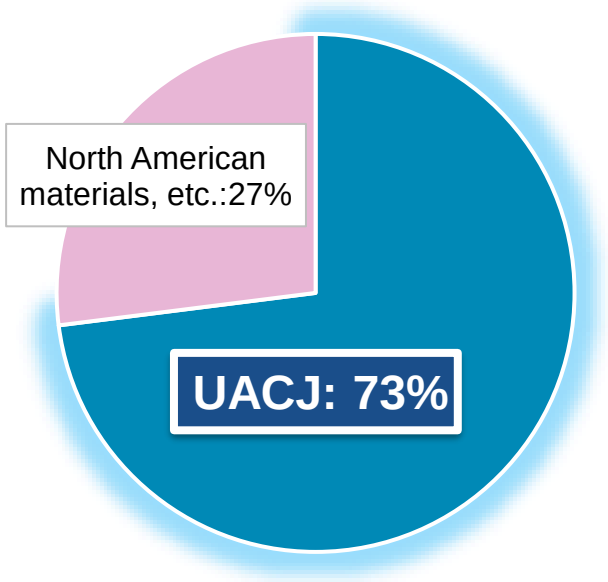
Delivering structural components for an increasing number of domestic rockets

Aluminum rocket products → Increase sales to meet growing demand

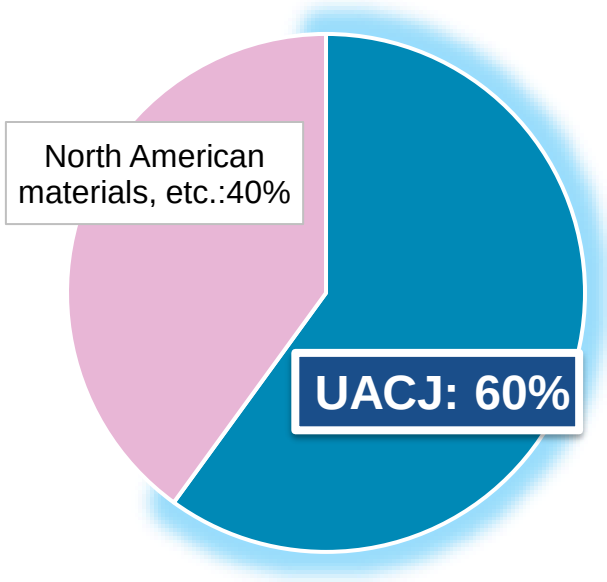
Share among domestic prime manufacturers

According to internal research at 2023

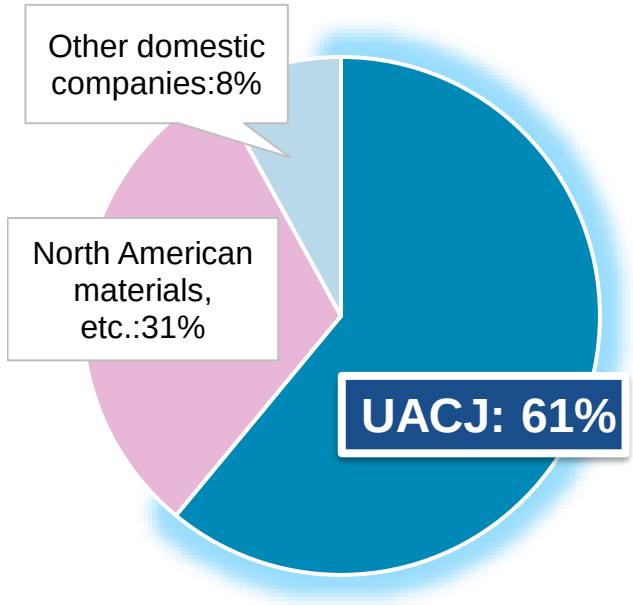
Plates



Extruded products



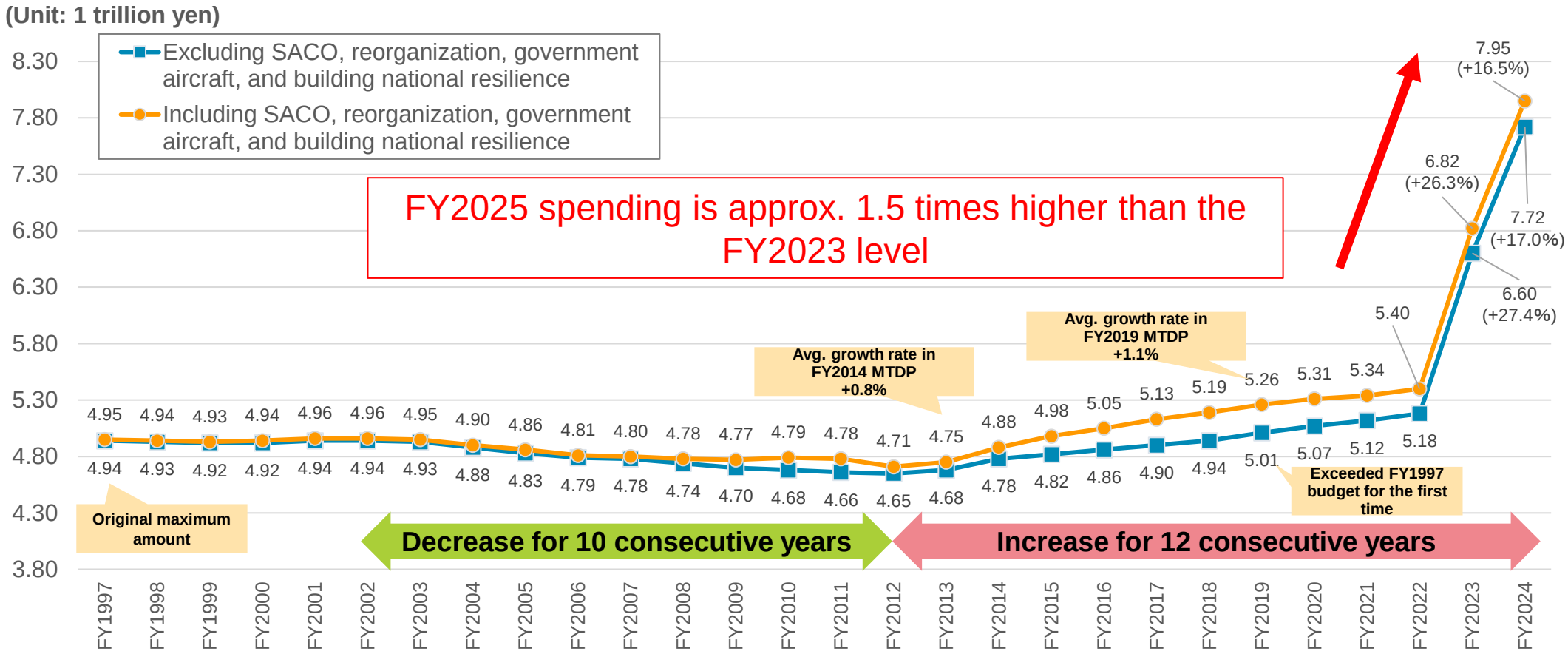
Forged products



Defense Demand

Defense spending in Japan

Defense spending is increasing in response to changing conditions in society



(Notes) 1. Expenses for the purchase of new government aircraft are included in the budget for FY2015 to FY2022.
2. Expenses for three-year emergency measures for disaster prevention, mitigation and national resilience are included in the budget for FY2019 and FY2020.

Source: Drafted by UACJ based on the 2024 Japan Defense White Paper

UACJ's Defense Market Share (Domestic)

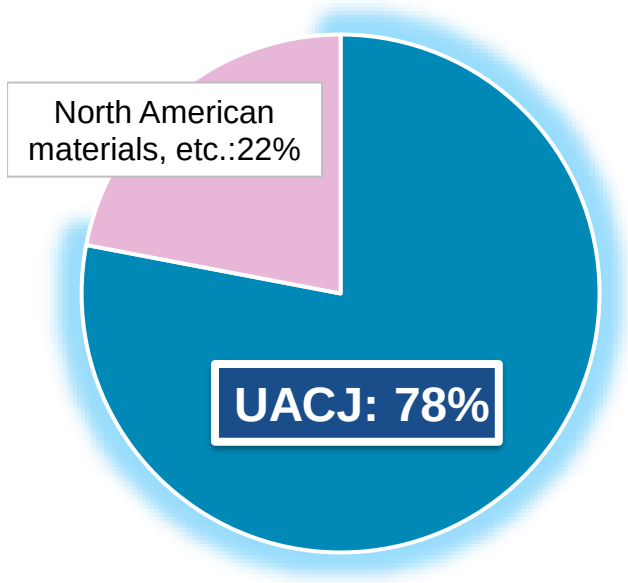
Expanded production system to support increased defense spending in Japan and capture demand for aluminum products

Aluminum defense products → Delivery of aluminum products in various shapes and applications

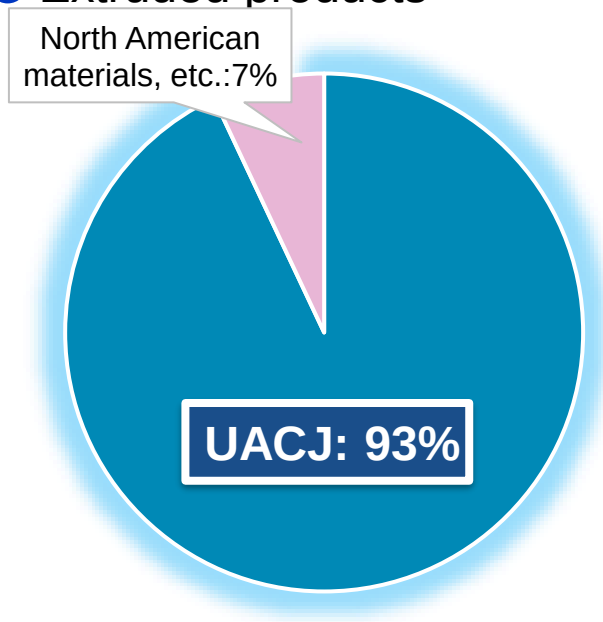
Share among domestic prime manufacturers

According to internal research at 2023

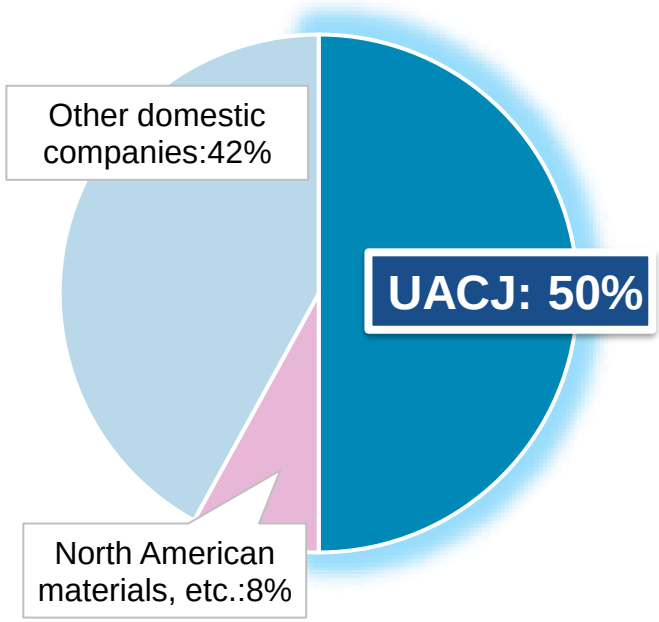
Plates



Extruded products



Forged products

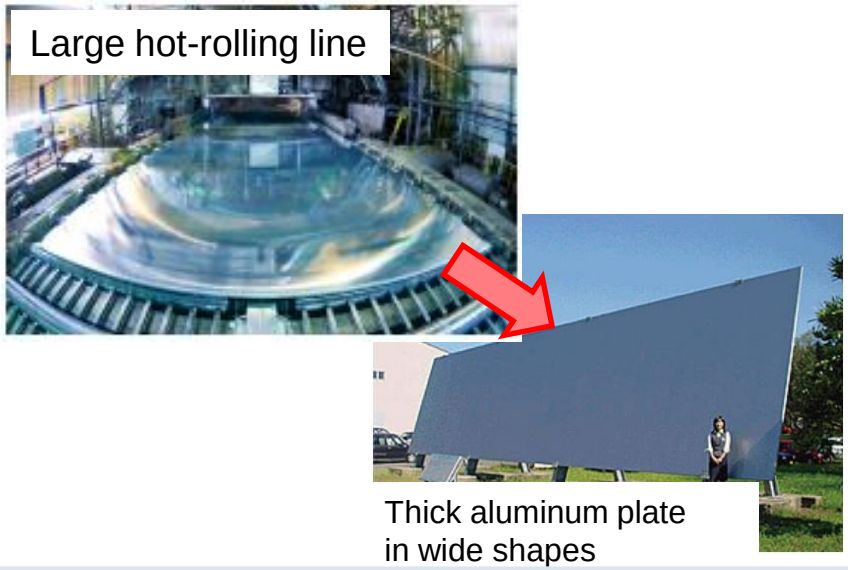


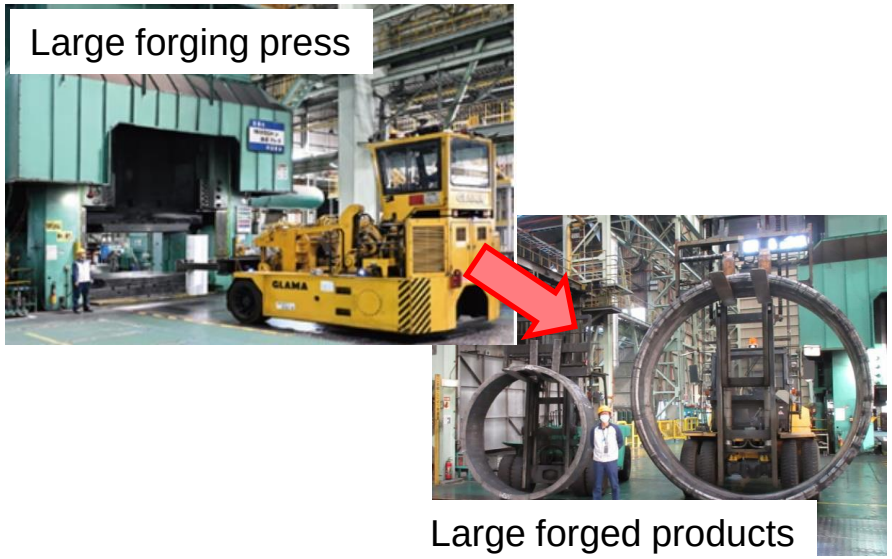
Strengths and Challenges in Aerospace and Defense Materials

Strengths

- Development and production of a variety of aluminum alloys
- Manufacturing of large-scale materials at some of **the largest production facilities in the country**

and others





Challenges

- Increasing capacity of heat treatment facilities for plates and extruded products used in aerospace and defense
- Further expanding capacity for large forged products **to gain a competitive edge over overseas suppliers**

and others

UACJ's Approach to Challenges

Plates

Increasing capacity of heat treatment facilities for aerospace and defense applications

→ Increase production capacity through capital investment in thick-plate quenching equipment

Cast/Forged Products

Further expanding capacity for large forged products

- Currently installing machining, inspection, and assembly equipment

  Expand supported product shapes to include more parts

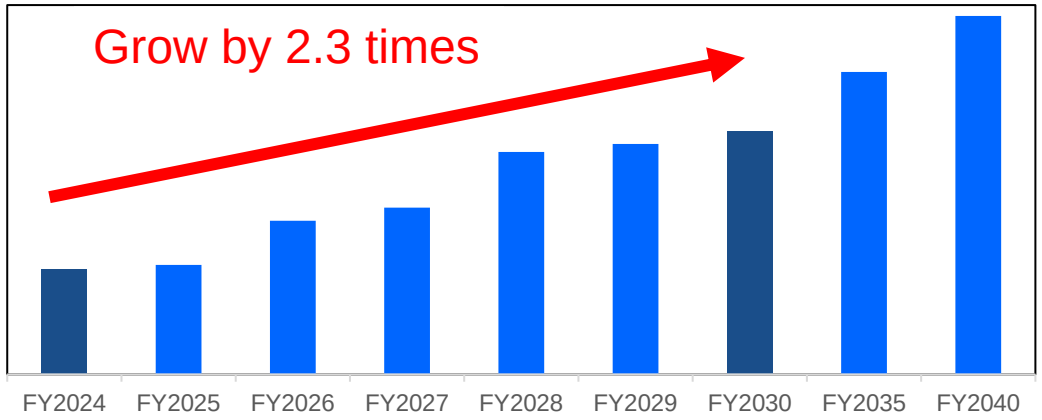
  → Following capital investment, the equipment will be operational from the second half of FY2025

- Installation of equipment to offer more sizes is under consideration

Toward Further Growth in the Aerospace and Defense Materials Business

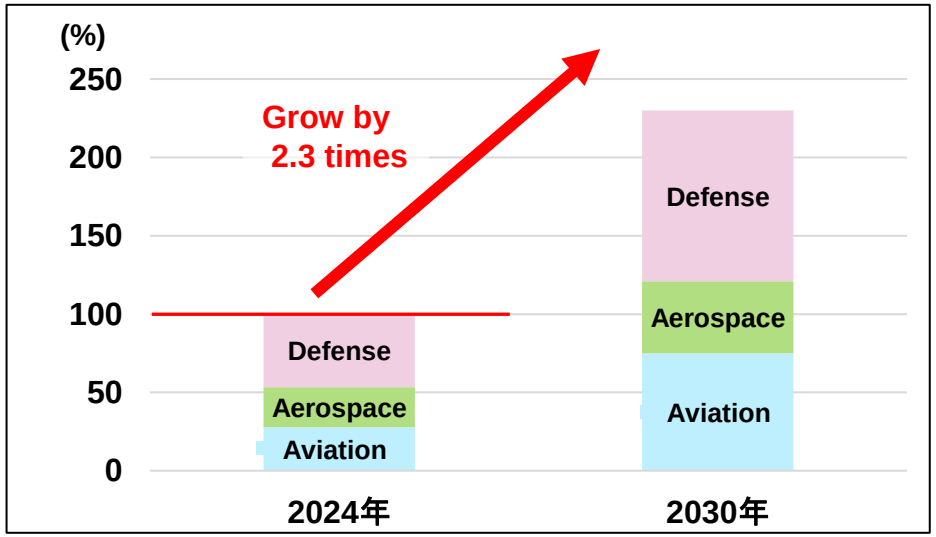
Sales plan for the three areas of aviation, aerospace, and defense

(Index with 2024 as 100)



Share of each area in the sales plan

(Index with 2024 as 100)



Sales measures, etc. to achieve FY2030 sales plan

Domain	Main measures	Plates	Extrusion	Forging
Defense	(1) **Strengthening relationships** with domestic Tier 1 companies and related ministries and agencies	○	○	○
	(2) **Establishing a system to increase production** (increasing UACJ's production capacity, securing subcontractors, etc.)	○	○	○
Aerospace	(1) **Achieving 100% share of UACJ materials used in** flagship rockets	○	○	○
	(2) Collaborating with **private start-ups** (strengthening relationships through materials, technical support, etc.)	○	○	○
Aviation	(1) Expanding new sales by **acquiring** North American aircraft manufacturer **certification**	○	○	
	(2) **Establishing** a UACJ materials **resale system** (switching to overseas materials for high-mix, small-lot items)	○		
	(3) Using large forging presses to partner with major European Tier 1 equipment suppliers; **entering the European & U.S. markets**			○
	(4) **Expanding sales channels** through collaboration with existing trading companies for **titanium and specialty steel**	○	○	○

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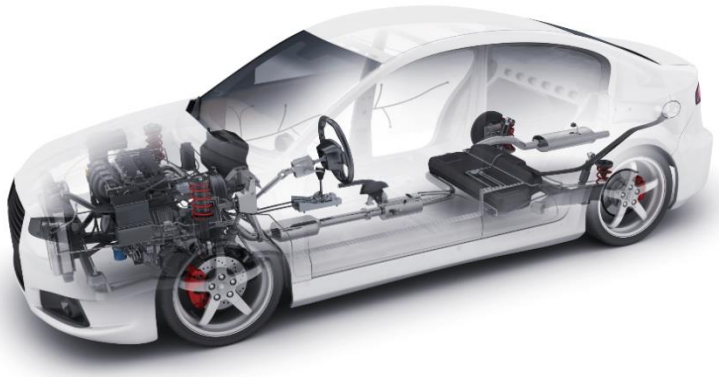
Aluminum: A Material with Rich Properties

- Resistant to low temperatures
- Strong conductivity
- Reflects light and heat
- Resistant to corrosion
- Good vacuum characteristics
- Strong heat conductivity
- Non-toxic
- **Lightweight**
- Easily soluble
- **High strength**
- Easy to bond
- Excellent recyclability
- Attractive appearance
- No magnetism
- **Easy to process**

In aerospace and defense, aluminum is primarily used for its **lightness, strength, and ease of processing**.

Domains with Products from UACJ

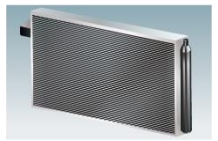
UACJ handles about 2,000 different alloys, used in various fields

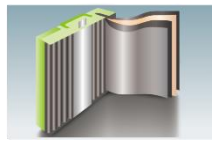


Automotive
2000(Cu,Mg), 3000(Mn,Mg),
4000(Si), 5000(Mg), 6000(Mg, Si)


Body paneling


Structural components


Heat exchanger material


Battery module materials

Beverage cans
3000(Mn,Mg), 5000(Mg)

Pharmaceuticals/ food
1000, 3000(Mn,Mg)

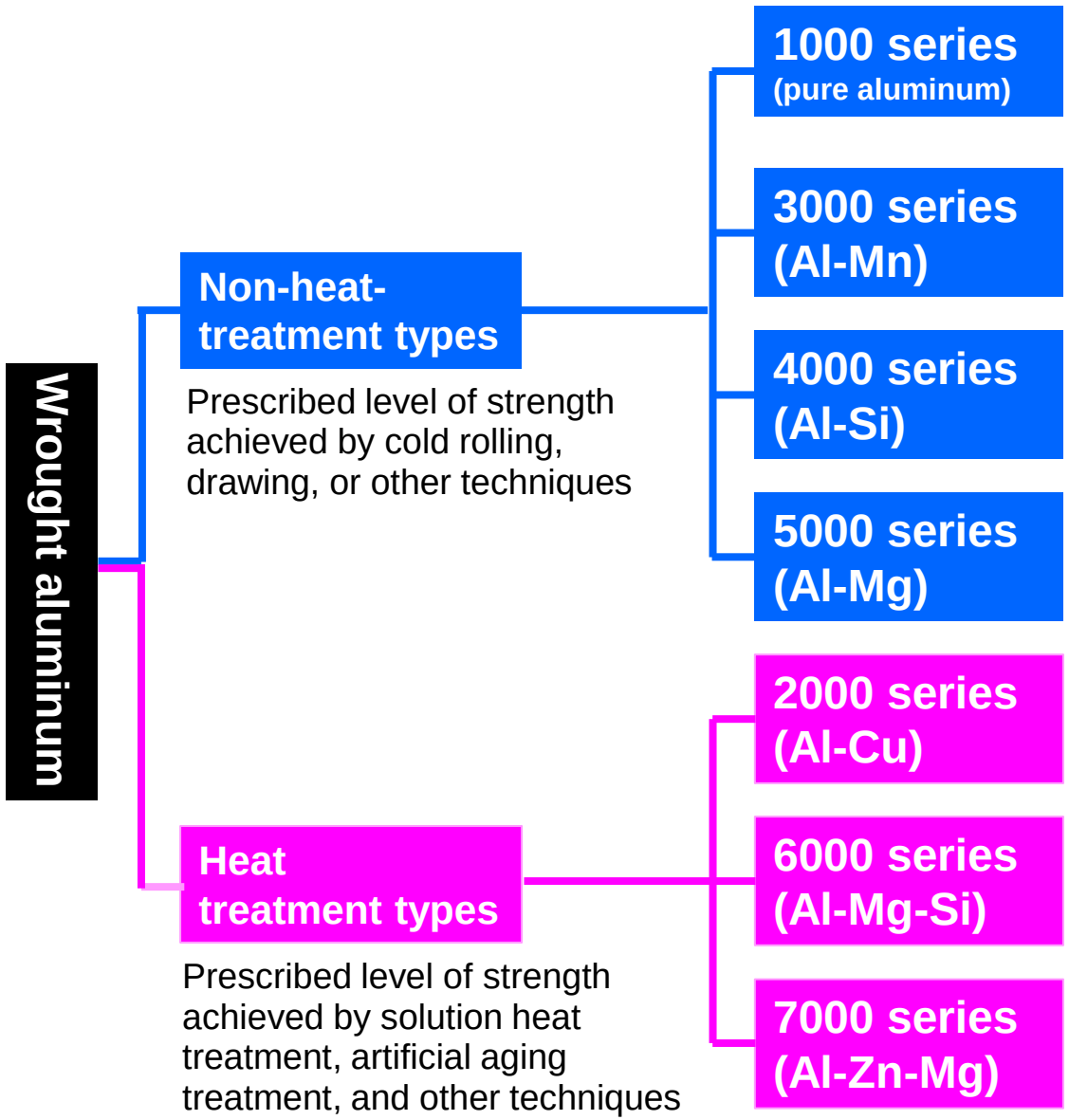
IT
5000(Mg), 6000(Si)

Aviation/aerospace
1000, **2000（Cu,Mg）,**
6000(Mg,Si),7000(Zn,Cu,Mg)

Marine
3000(Mn,Mg), 5000(Mg)

Construction
6000(Mg,Si)

Wrought Aluminum Alloys and Applications



Characteristics: Excellent workability, corrosion resistance, weldability, electrical and heat conductivity, etc.; however, low strength
Main applications: Reflector plates, fins, etc.

Characteristics: High strength without reducing the corrosion resistance of pure aluminum
Main applications: Can bodies, battery cases, etc.

Characteristics: Low melting point, excellent corrosion and wear resistance
Main applications: Brazing materials, forged pistons, etc.

Characteristics: Non heat-treatment aluminum with the highest strength and excellent formability
Main applications: Can ends, structural materials, automotive parts, etc.

Characteristics: High strength but poor corrosion resistance
Main applications: **Aircraft, machine parts**, etc.

Characteristics: Good strength and corrosion resistance
Main applications: Sashes, **machine parts**, automotive exterior panels and parts, etc.

Characteristics: Highest strength among aluminum alloys
Main applications: **Aircraft, structural materials**, etc.

Aluminum Types Used in Aerospace and Defense

Major alloys used in aerospace and defense

- 2000 series alloys: Al-Cu
- 6000 series alloys: Al-Mg-Si
- 7000 series alloys: Al-Zn-Mg

All notable for **high strength**

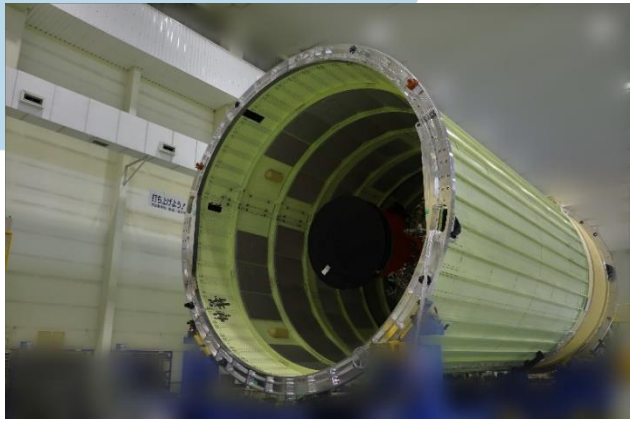
Alloys strengthened by heat treatment

Large heat treatment furnace (forging)

Swindell furnace (extrusion)

Requires highly accurate and controllable heat treatment technology

Aluminum Types Used in Aerospace and Defense



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Aviation, aerospace, and defense products

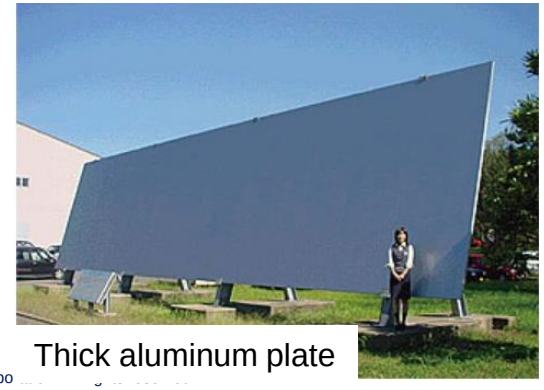
There is often a rigorous requirement for products **to be light**

Ensuring strength with extreme lightness

- High-strength alloys are selected
- Precision machining enables lightweight products

Welded joints reduce strength

- Machining from large materials allows for unibody parts



Thick aluminum plate

Large stretcher (plates)

Large machining center

Large forged products

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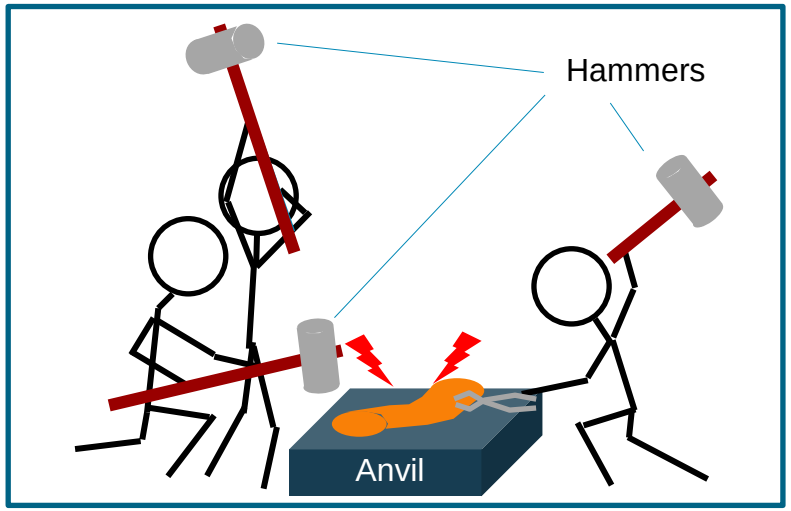
About Forging

Traditional forging

Traditional smithing (e.g., of swords)



- Material: Iron
- Tools: Anvil, hammers

Forging at UACJ

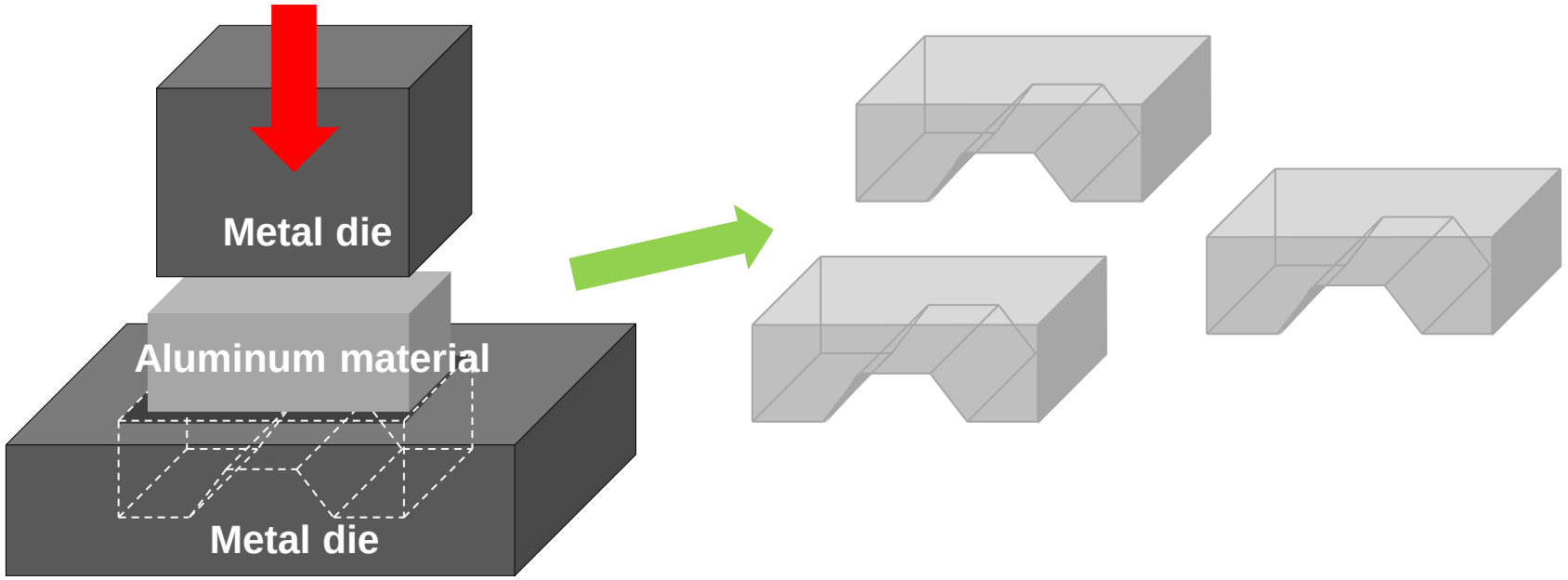
Forging with a large press

- Material: Aluminum
- Tools: Anvil, large press

About Forging: Die Forging

Die forging

Forging method using dies to shape (form) metal



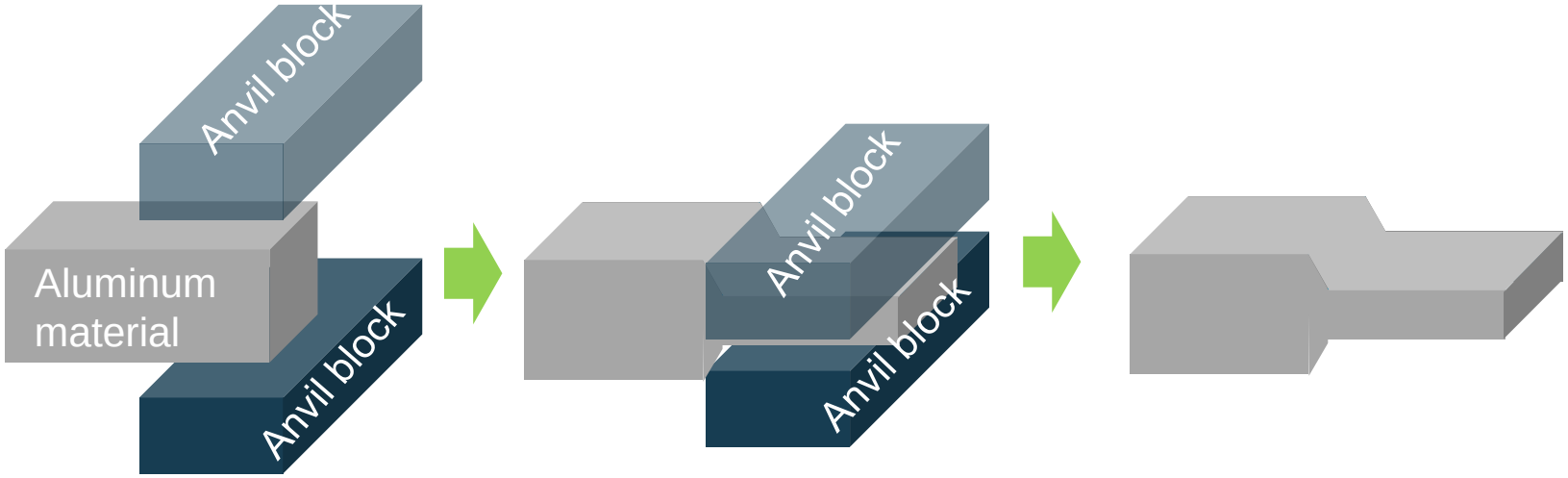
Features

- Enables mass production with uniform shape
- Only manufactures one shape
- One die is needed for each product

About Forging: Free Forging

Free forging

Forging method using an anvil or jig to shape (form) metal



Features

- Capable of manufacturing various shapes
- Forms metal into relatively simple and rough shapes
- Forms by combining various anvil blocks and jigs

About Forging: Free Forging Examples

Free forging examples

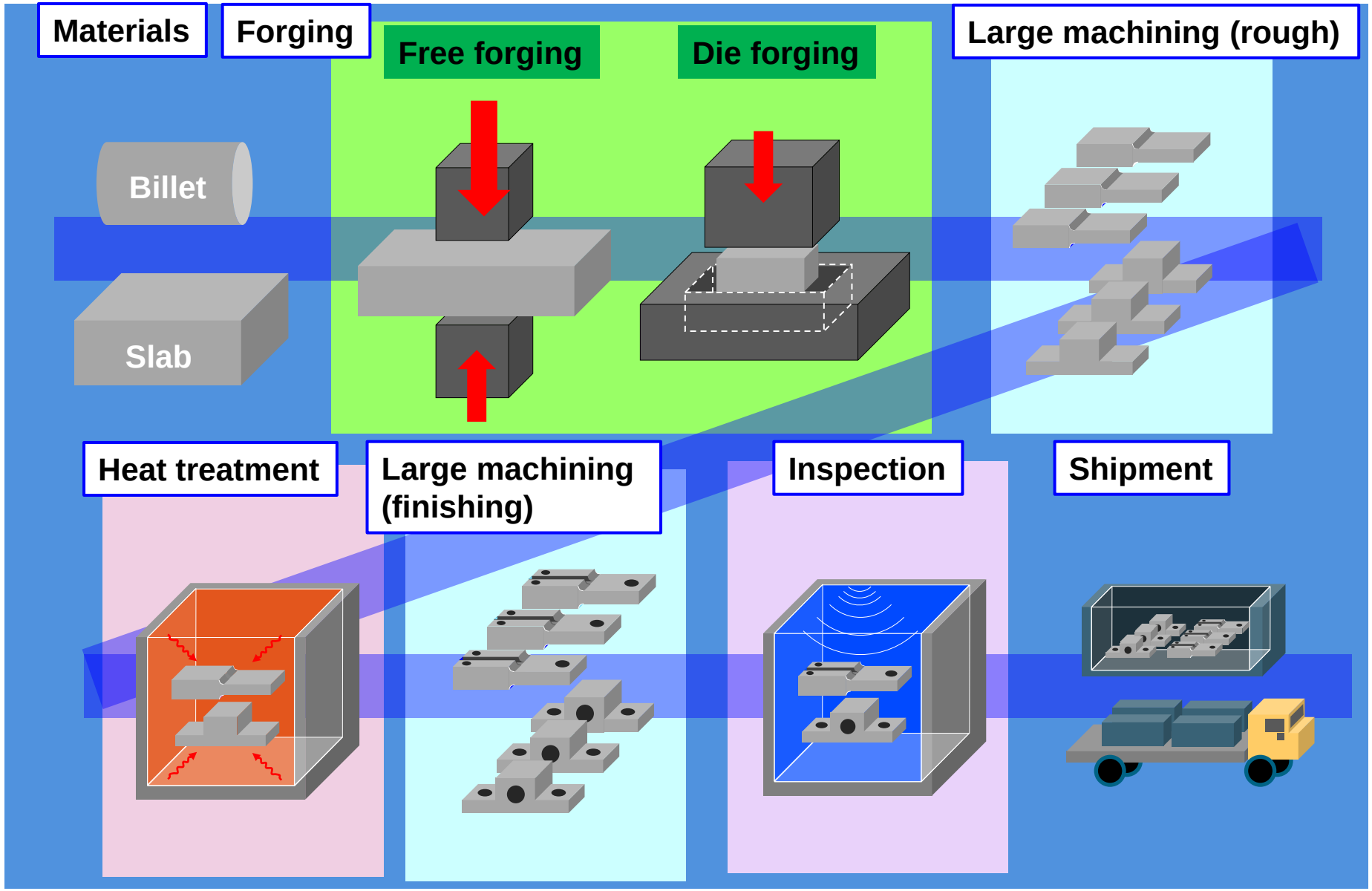
Plates

Rings

Cylinders

- Production possible with various alloys
- Supports production by single piece/lot
- Can handle complex shapes unavailable with rolling and extrusion

Manufacturing Process Overview



Manufacturing Process: Forging Presses

Types of Forging Presses	1,000ton Press	3,000ton Press	5,000ton Press	15,000ton Press
Height above ground (mm)	6,000	10,500	7,000	13,000
Work opening width (mm)	1,900	2,240	2,000	4,500
Pressure (t)	1,000	3,000	5,000	15,000
Open height (mm)	2,000	3,300	1,750	3,300
Stroke (mm)	1,300	2,000	700	2,500

Main Facilities: Forging Presses, Heat Treatment Furnaces

15,000-ton press

3,000-ton press

No. 7 solution treatment furnace

No. 8 aging furnace

Quality Assurance System

Delivering world-leading products of the highest quality

ISO14001 certificate of registration

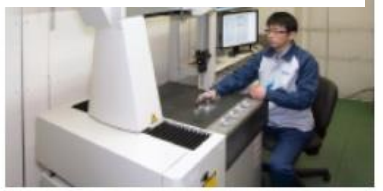
ISO9001/AS9100 certificate of registration

Nadcap NDT (nondestructive testing) certification

Nadcap HT (heat treatment) certification

Dimensional inspection

Coordinate measuring machine



Test/inspection items (examples)

- Hardness measurement
- Electrical conductivity measurement
- Tension test
- Ultrasonic test
- Stress corrosion cracking test
- Peel strength test
- Fracture toughness test
- Fluorescent penetrant test
- Metallographic observation
  Micro/macro examination
- Various chemical analyses

and others

Recycling and Resource Recovery Efforts at the Foundry and Forging Works

Chips generated in machining

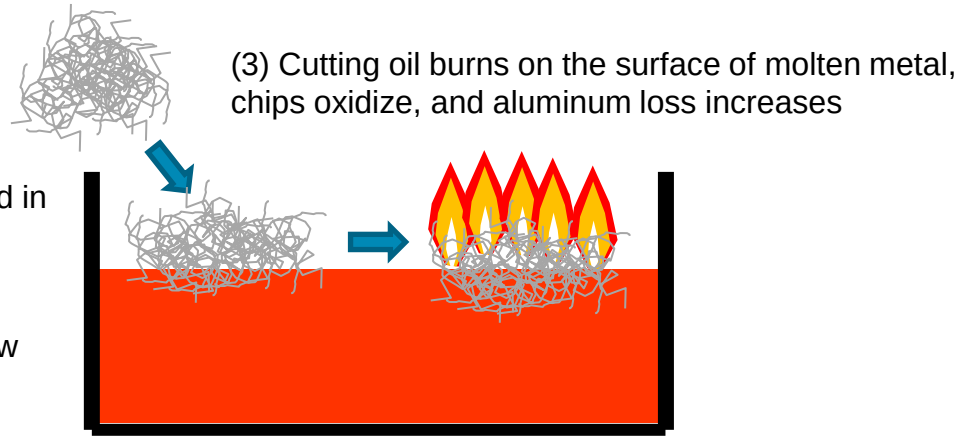
- Contaminated with cutting oil
- Shapes vary depending on cutting conditions

⇩ Thickness, length, bend, etc.

⇩

Small “bulk (apparent) density” (less than 1g/cm^3) even when collected

⇨ **High loss when melted for recycling**



Chips generated in machining

Combustion

Recycling and Resource Recovery Efforts at the Foundry and Forging Works

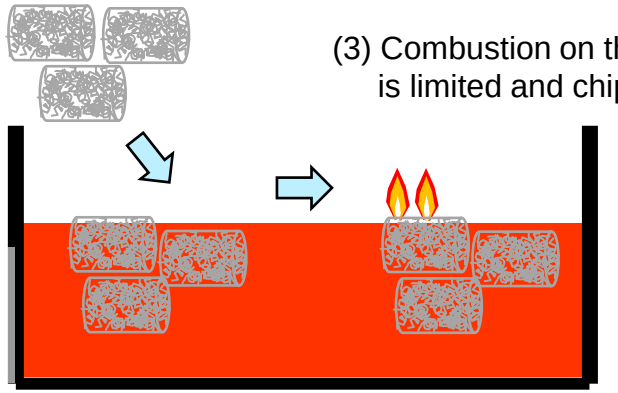
Chips are mechanically compacted by a briquetting machine to squeeze out cutting oil and form briquettes suitable for melting

- Briquetting machine

- Briquette (solid block)

Bulk density:
2.2g/cm^3 or more

(1) Briquettes are fed in



(2) Unlikely to float in molten aluminum due to high bulk density

(3) Combustion on the molten metal surface is limited and chips are efficiently melted

More than 97% of aluminum can be recovered and recycled if properly melted

Recycling more than 100 tons of chips a month

UACJ

Aluminum lightens the world

アルミでかなえる、軽やかな世界