

High Volume Aluminum Solutions for Lightweighting

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Novelis is the Global Leader in Aluminum Sheet



Sales



Operations



Research &
Technology



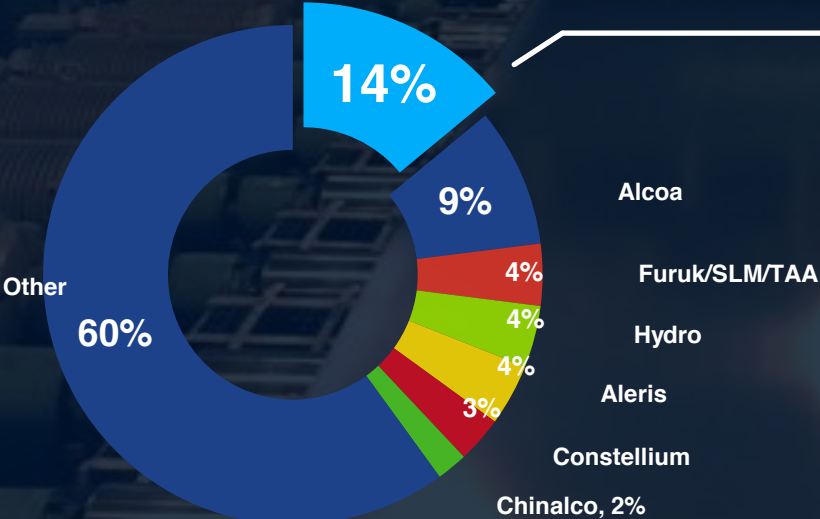
Executive
Offices

GLOBAL ALUMINUM
LEADER IN:



Global Flat Rolled Products

World Leader in Rolled Aluminum



Novelis #1
Rolled Products
Supplier Worldwide

Total 100% = 22 million tons
Top 6 = 40%

Source: Novelis estimates, 2014 data

Not just aluminum, Novelis Aluminum.

Novelis' Unique Portfolio of Alloys



Exterior



Inner/Structure



Strength



Crash

Novelis New Product Launches

Advanz™ Fusion e200*
Advanz™ e200

Advanz™ s200
RC5754
RC5182

Advanz™ s615

Novelis Global Products

Advanz™ e170
Advanz™ e600

Advanz™ s118
Advanz™ s600

Advanz™ c300

Standard Products

5754
5182

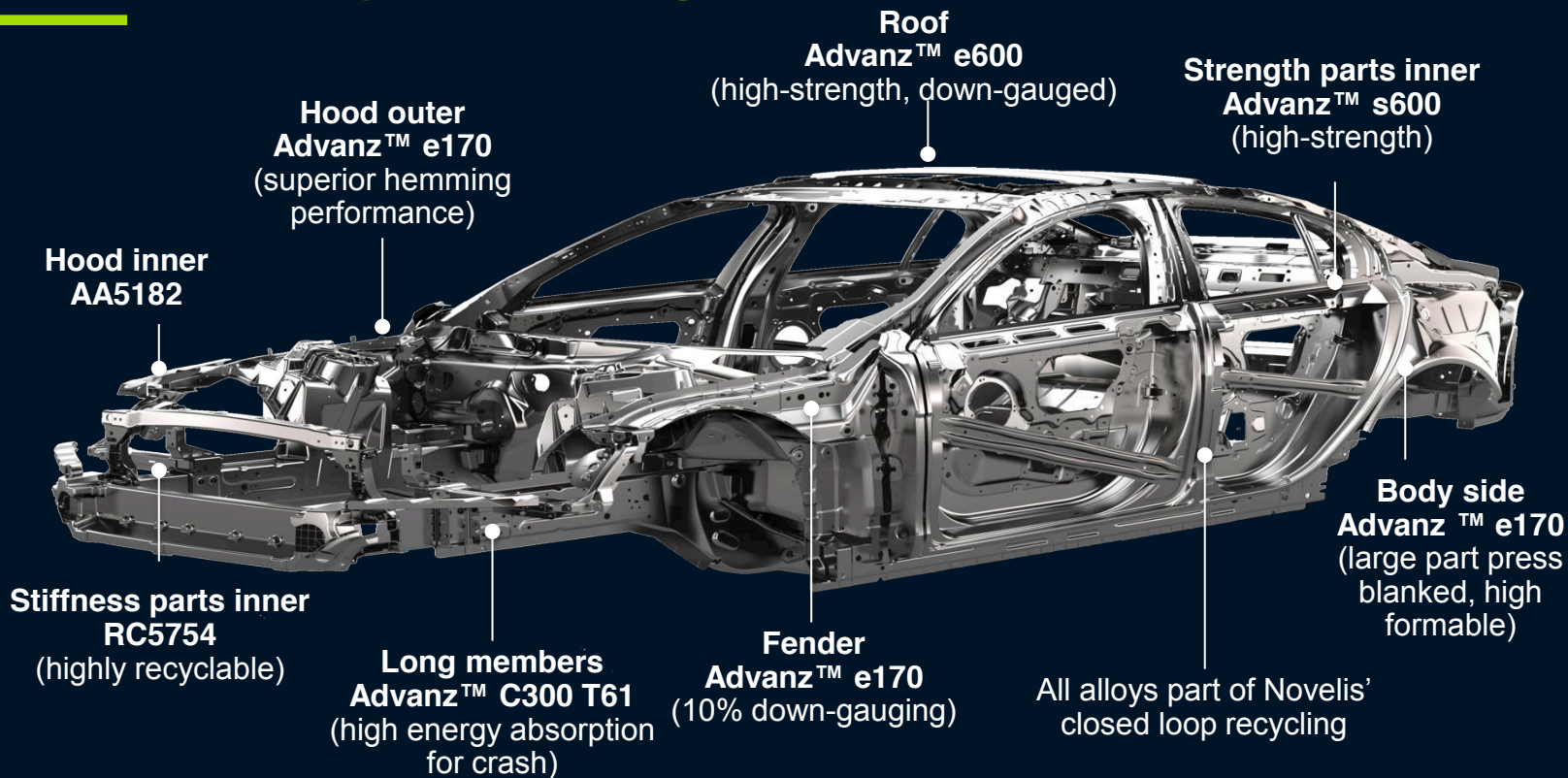
6111

* Final product name subject to change

Generations of Pioneering Automotive Technology



Jaguar XE: Built with Novelis Alloys Throughout



Alloys for Strength and Crash Energy



Novelis

Strength – Toughness Dominated Sheet Products

Advanz™ s615

Status: In-production

- In-service T8x (After Paint Bake):
Yield Strength: 250 MPa+
- Post-form Artificially Aged (PFAA) Condition:
Yield Strength: 290 MPa
- PFAA material is rivet-able with Self-Piercing Rivets (SPRs), Resistance Spot Welds, etc.
- Developed to meet Ford's demanding 6HS2 specification but designed for a wide range of commercial applications



Advanz s615 launched in the 2015 Ford F-150

Performance & Flexibility: Advanz™ s615 Example



$$P_m \approx 50 * \sigma_u * t^{1.7}$$

Jones & White (1998)

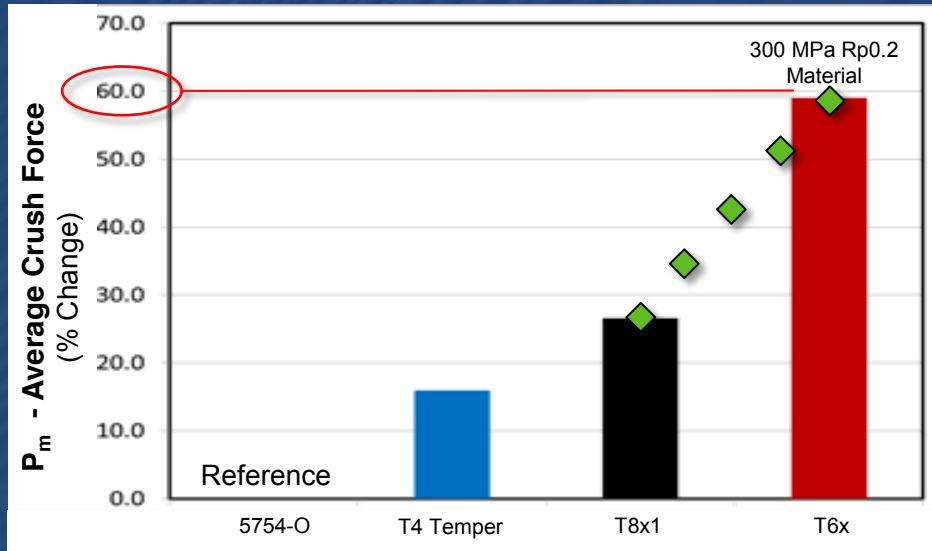


5754-O

S615-T8x1

S615-T6x

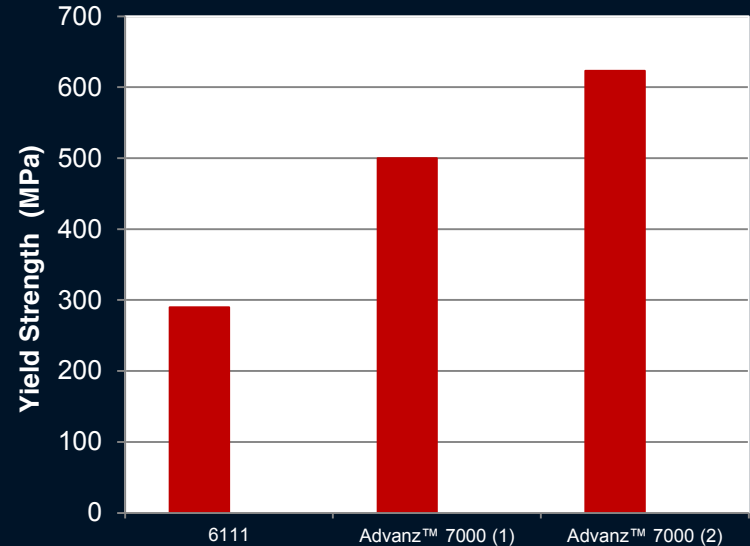
Energy Absorption for Different Strength Conditions (Quasi-Static Crush Tests)



Note: All tests were done with 2mm thickness

Next-Gen High-Strength Automotive Alloys – Novelis Advanz™ 7000-series

- Designed for unsurpassed vehicle lightweighting and passenger safety
 - Yield Strengths above 500 Mpa
 - Yield Strengths above 600 Mpa in development
 - Tailored to specific applications
 - Good elevated temperature formability



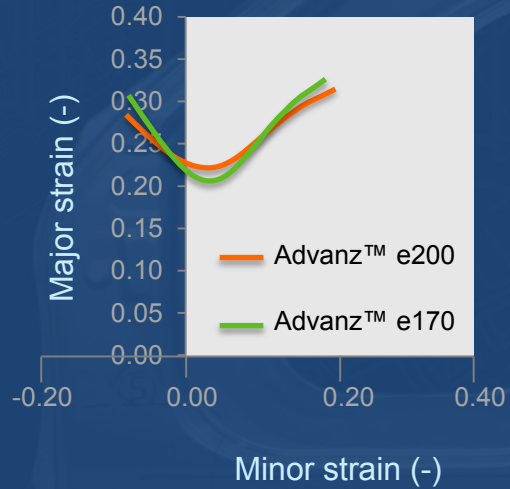
Solutions for Forming & High Speed Joining

Novelis

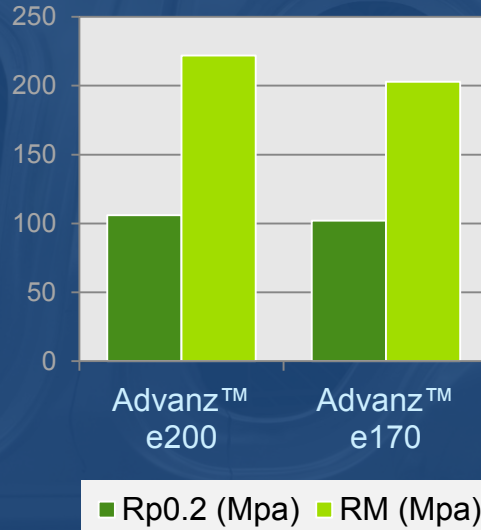


Advanced Formability

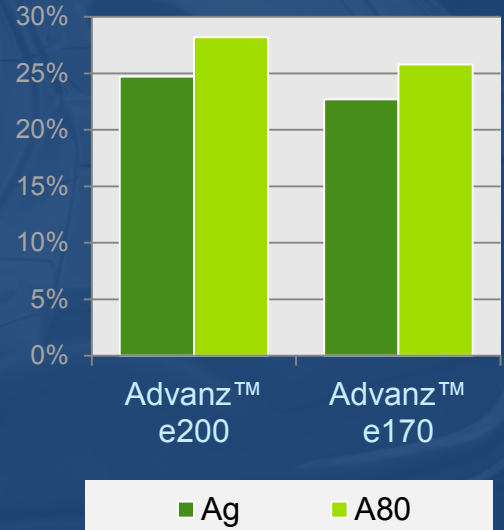
HIGHER FLC_0



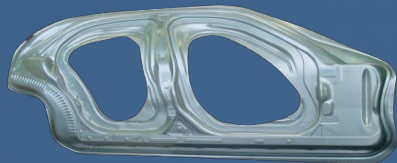
MORE STRAIN HARDENING



MORE ELONGATION



Bodyside Evolution in Aluminum at JLR



XJ (X350) Bodyside

- NG5754
- 1.5mm



XJ (X351) Bodyside

- AA6111
- 1.2mm



Range Rover Bodyside

- Advanz™ e170
- 1.1mm

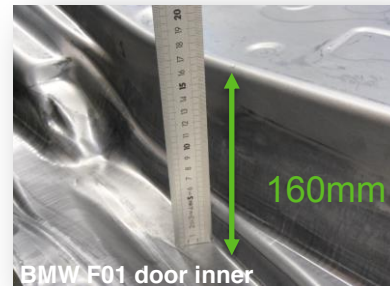
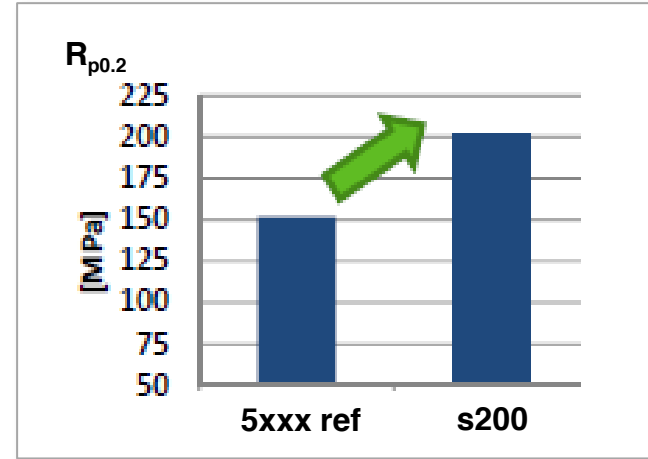


Advanced Formability

Benefits for door inners

- Down-gauging due to high strengthening in paint bake
- Uni-Alloy (6xxx series) approach for enhanced closed-loop recycling
- Deep draw capability

Successful Forming Trials
With Advanz™ s200



Doors and Closures in Car Body Engineering 2014

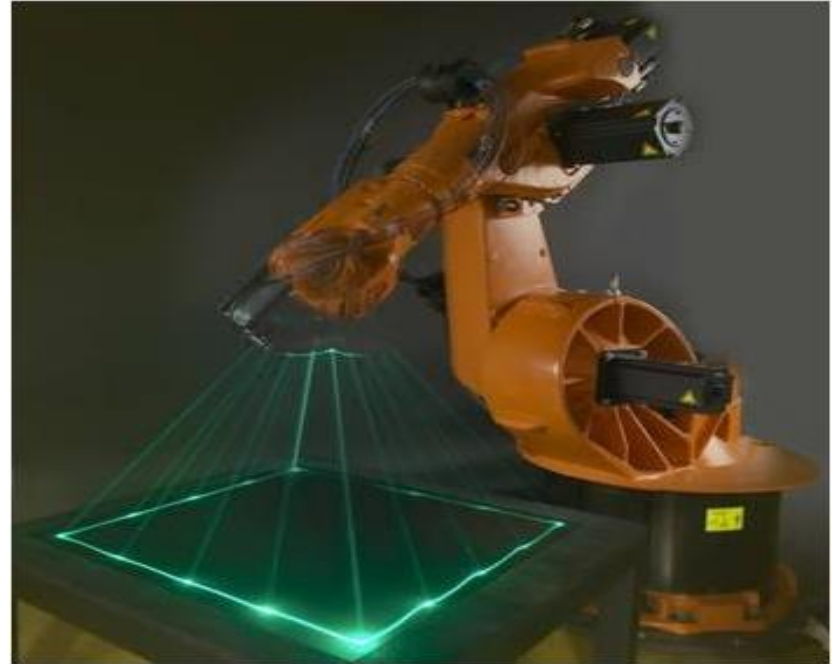
Not just aluminum, Novelis Aluminum.

Joining Productivity with Remote Laser Welding

- Much faster than conventional technique with filler metal
- Allows more complex welds
- Better weld sequence optimization

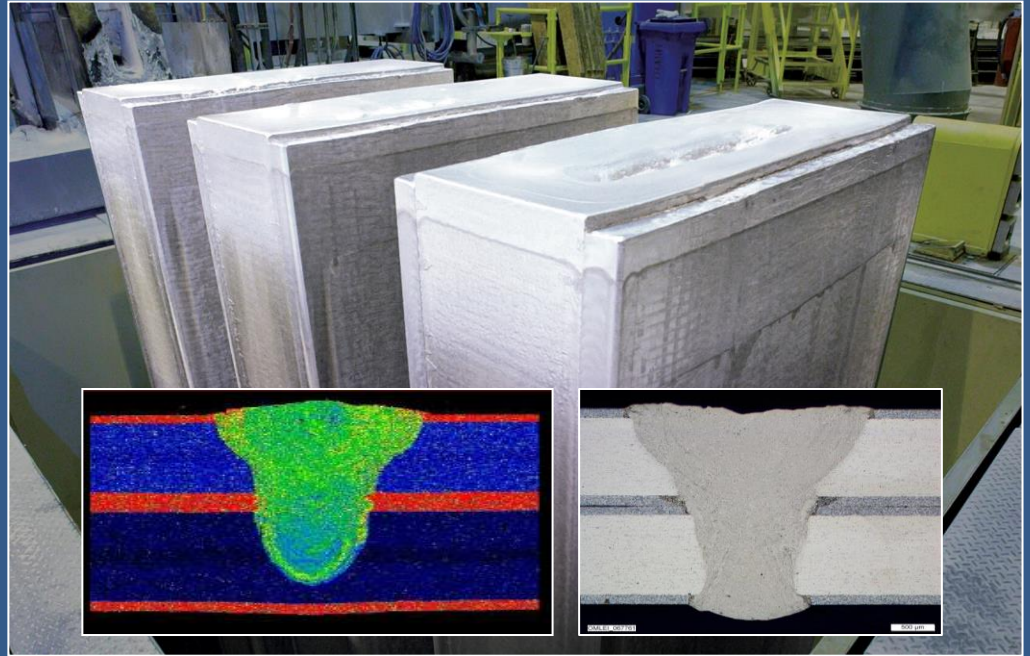
The Challenge:

- 6xxx series alloy crack sensitivity without a filler wire



Enabler for Remote Laser Welding: Advanz™ s200 RW

- Weldable without filler metal
- Fusion™ casting technology
- Maintains the benefits of 6xxx monolithic products



Adhesive Bonding Technology Innovation



Novelis

Novelis and Henkel Partner on Advanced Bonding Technology for High-Volume Aluminum Vehicles

- Global collaboration for Next-generation solutions for the aluminum industry adoption, *free from licensing*
- **Bonderite M-NT 8453**, the first product from the partnership
 - Designed to meet all customer requirements and fit all Automotive production lines globally
 - Key advantage: Versatility and cost-effectiveness for high volume, aluminum bonded structures



Bonderite M-NT 8453: Next Generation Bonding Technology

Ti, Zr fluorides and Henkel's proprietary polymer formulation pre-treatment provides industry-leading adhesion and corrosion resistance

Automaker Approvals

- Already approved by a global automaker
- Undergoing approval testing with multiple global automakers

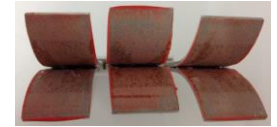
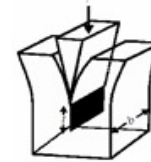
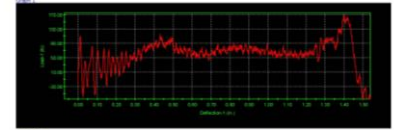
Tests Passed to Date

- The most severe Stress Durability testing in industry
- Neutral Salt Spray - 20 weeks
- Impact peel test
- Resistance Spot Weld
- E-coat/Paint and Corrosion

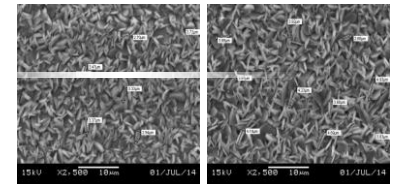
Production Versatility

- Spray
- Roll-on-dry-in-place
- Immersion coating

Fracture toughness results met OEM requirement



SEM Micrographs of Zn-P structure



Where Do You Find Novelis Aluminum Today?

On the vehicles people want to drive.....



Not just aluminum, Novelis Aluminum.