

Secat, Inc.

Center of Excellence for the
Aluminum Industry

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Mission

Secat, Inc. will be the preferred center of excellence for providing external technological and intellectual services to satisfy the needs of the aluminum industry, its constituents, suppliers, and customers.

Objectives

- ✓ Perform proprietary, collaborative, and industry-wide research and materials testing projects
- ✓ Enable aluminum companies to develop new products and processes
- ✓ Assist aluminum companies in identifying new market opportunities
- ✓ Provide training opportunities for students and prepare them for the aluminum industry
- ✓ Provide technical assistance to aluminum industry.

The Secat Advantage



State-of-the-art research and testing laboratory



Short turnaround time



Seamless interaction with national laboratories and universities

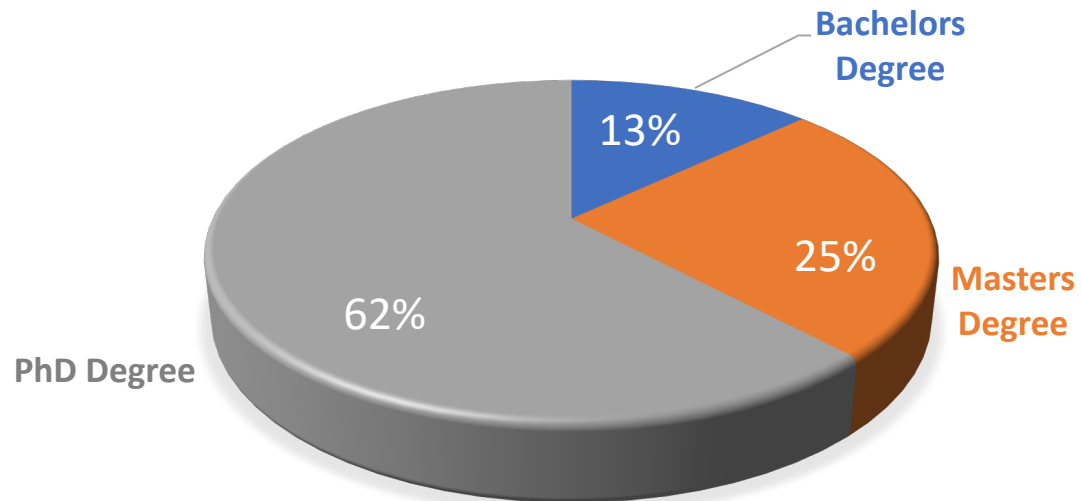


Intellectual property protection

The Secat Advantage - Secat Staff

The Secat laboratory maintains a team of highly skilled personnel with an in-depth knowledge of aluminum.

MATERIAL'S ENGINEERING TEAM

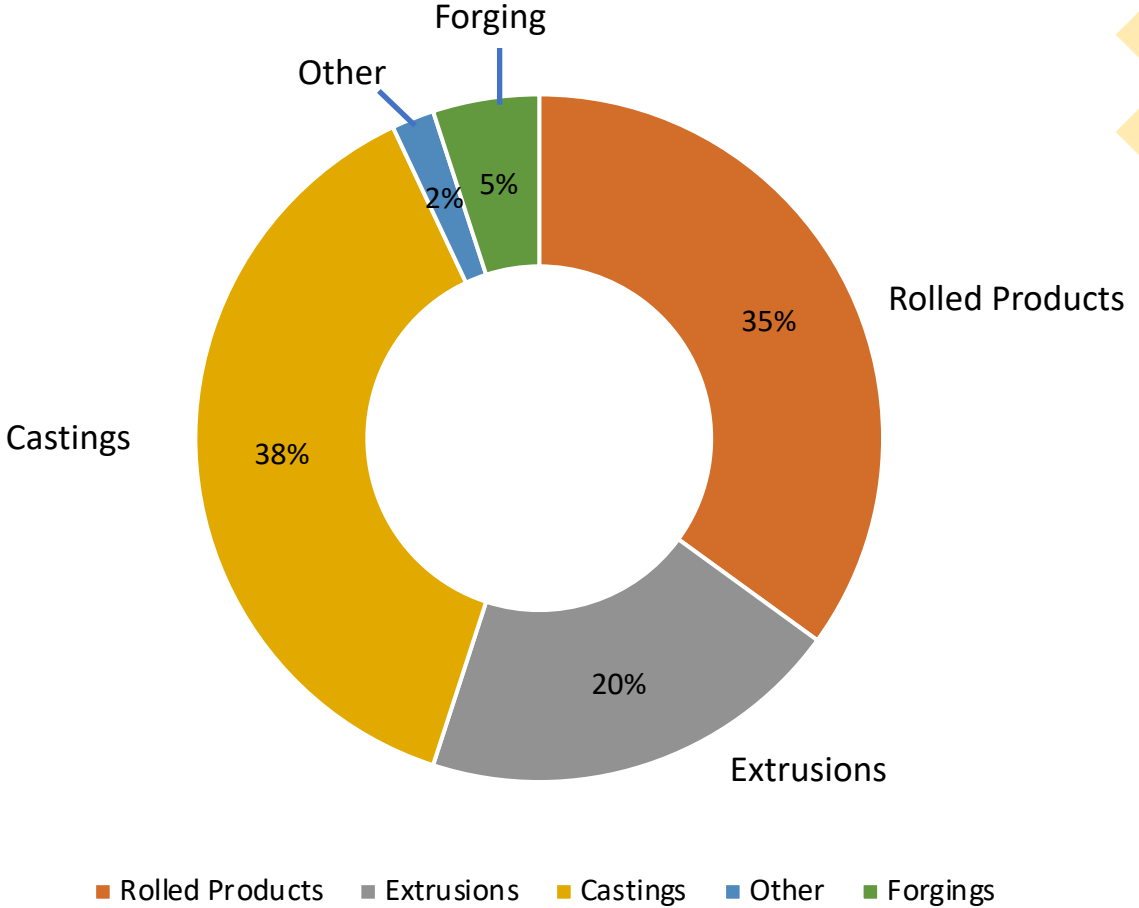


- Experienced business analysts
- Consultants and specialists with decades of industrial experience.
- Materials engineers with their advanced education and industrial experience provide a unique and valuable resource for aluminum companies.

Serving a Broad Client Base



Over the years Secat has experience working with 300+ customers from every facet of the aluminium industry.



Partial List of Clients



The Secat Laboratory

The Secat laboratory is housed in a specially designed 10,000-square-foot research facility in Lexington, Kentucky, USA.
(ISO 17025 accredited)

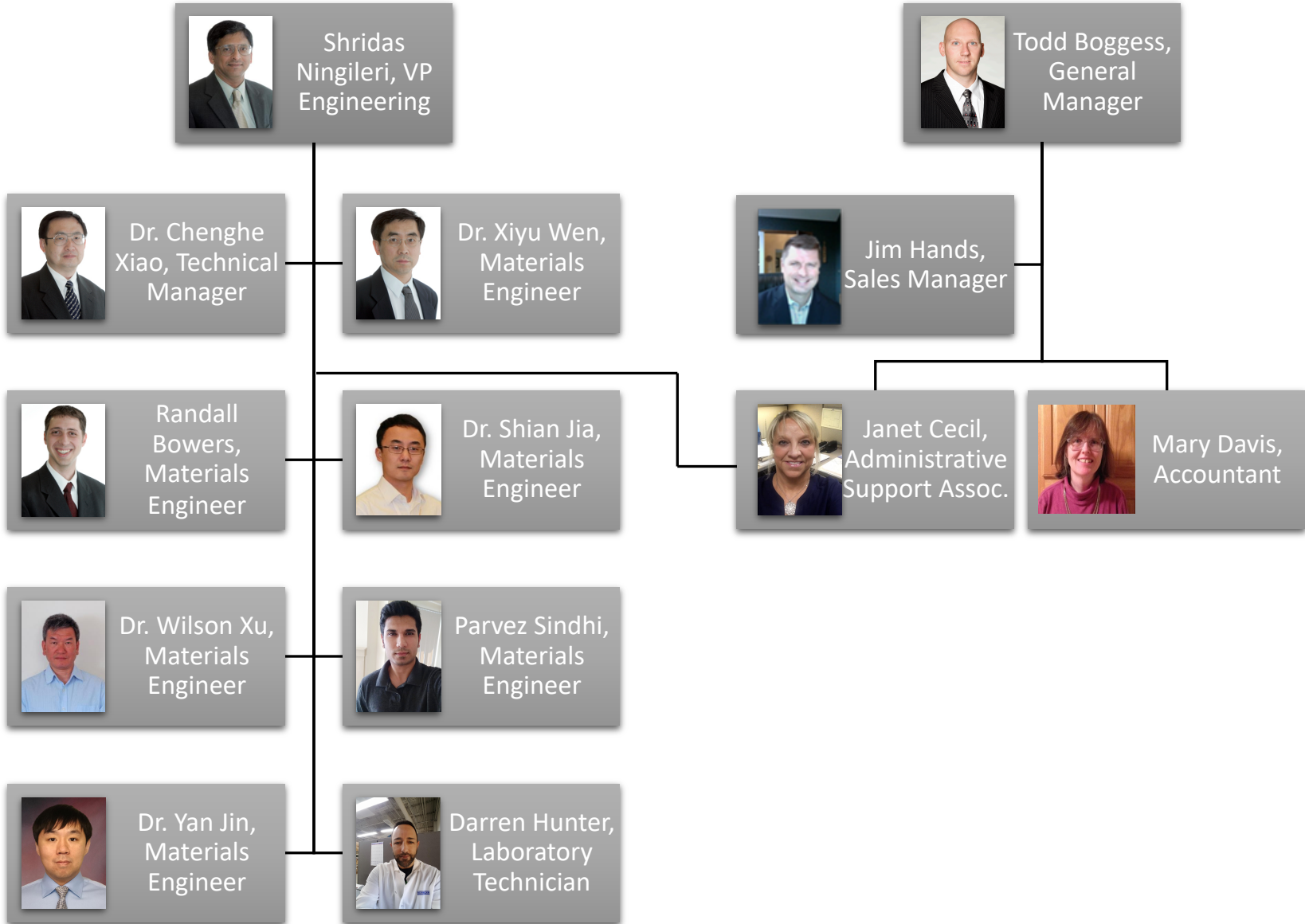
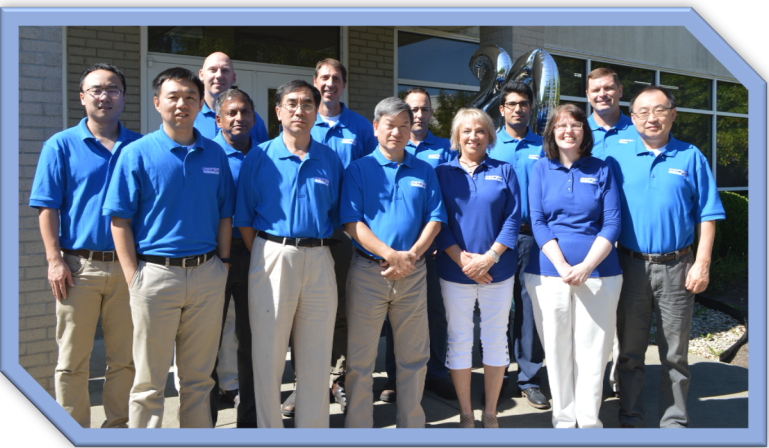
A broad range of material testing and characterization capabilities are available to support proprietary and collaborative projects:

Surface Related Measurement
Microstructural / Metallographic
Electrical Resistivity / Conductivity
Micro / Macro Hardness
Heat Treatment
Molten Aluminum Quality

OES Spectrometer
X-RAY Diffraction
Mechanical Testing
Metal Forming
SEM EDS / EBSD
Image Analysis



Organization Chart



Laboratory Equipment

Materials Preparation:

- Hydraulic Shear
- Band, Tabletop Cutoff Saw
- Hot Mounting Press
- Automatic Polisher/Grinder
- Electro polisher/etcher
- Tensile sample cutters
- Rolling mill

Microstructural Characterization:

- Rigaku D/Max X-ray Diffraction Unit
- Olympus Stereo Microscope
- Olympus Inverted Microscope
- Olympus Upright Microscope
- Image Analysis System
- Olympus Digital Camera
- Stereo Microscope

Laboratory Equipment

Metal Cleanliness and Heat Treatment:

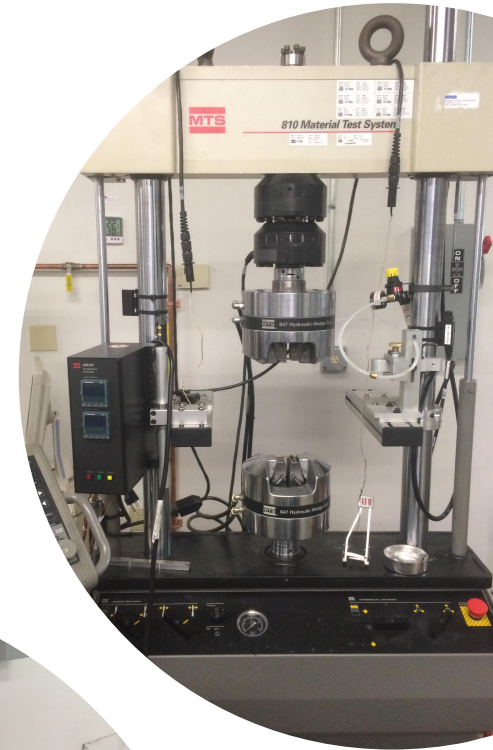
- ALSCAN, PodFA, Prefil-Footprinter (Hydrogen, inclusions in molten aluminum)
- Heat treatment furnaces
 - Aging
 - Solution Heat Treatment
 - Annealing
 - Induction Heater
 - Salt Bath Heat Treatment
- Differential Scanning Calorimetry



Laboratory Equipment

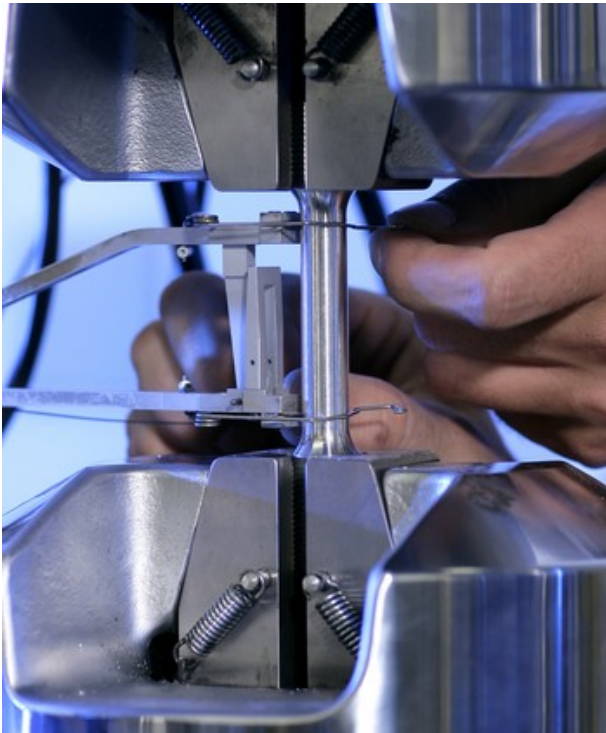
Mechanical Testing & Chemistry Analysis:

- MTS 810 Servo Hydraulic Testing System
- MTS Landmark Servo hydraulic Testing System
- MTS Insight Foil Tensile Tester
- Tinius-Olsen Ductomatic Sheet Metal Tester
- Earing, Olsen Cup, Hole Expansion and Forming Limit Diagram
- Mitutoyo Rockwell and Superficial Hardness Tester
- Mitutoyo Microhardness Tester
- Huxley Bertram Earing Measurement System
- Bending Tester
- Can Body/Can Lid Buckle Tester
- Electrical Resistivity/Conductivity
- Surface Roughness – Contact Stylus
- Optical Emission Spectrometer for chemistry

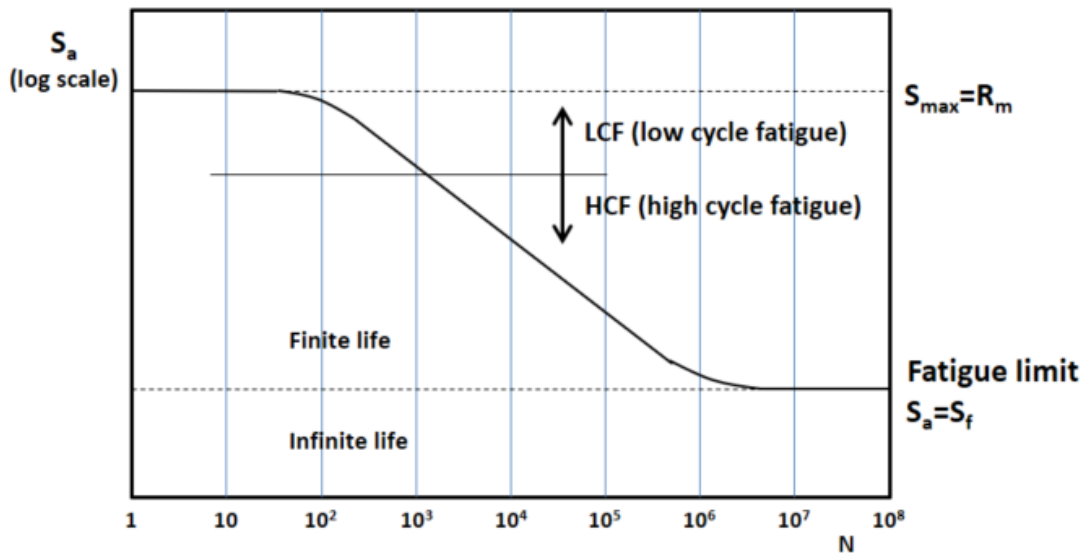


Mechanical Testing – Fracture

- Secat can perform linear elastic and elastic-plastic fracture toughness testing.
- The available testing equipment can be used for both pre-cracking and fracture testing.
- A variety of tests can be performed:
 - Fracture toughness
 - Crack propagation
 - Component strength and durability
 - Environmental testing
 - Thermal mechanical fatigue
 - Tension
 - Compression
 - Bending
 - Stress relaxation
- Secat's test system features the test space and performance flexibility required to perform both static and dynamic component testing.



Mechanical Testing - Fatigue



- Secat can perform highly accurate fatigue tests:
 - Constant Amplitude
 - Variable Amplitude
 - Block Loading
 - Low Cycle Fatigue
 - High Cycle Fatigue
- Fatigue Analyzer software allows Secat to glean new insight from post-test data.
- State of the art equipment allows tightly controlled and consistent through-zero specimen loading.
- Can test components and materials such as aluminum, composites, steel, super alloys and more.

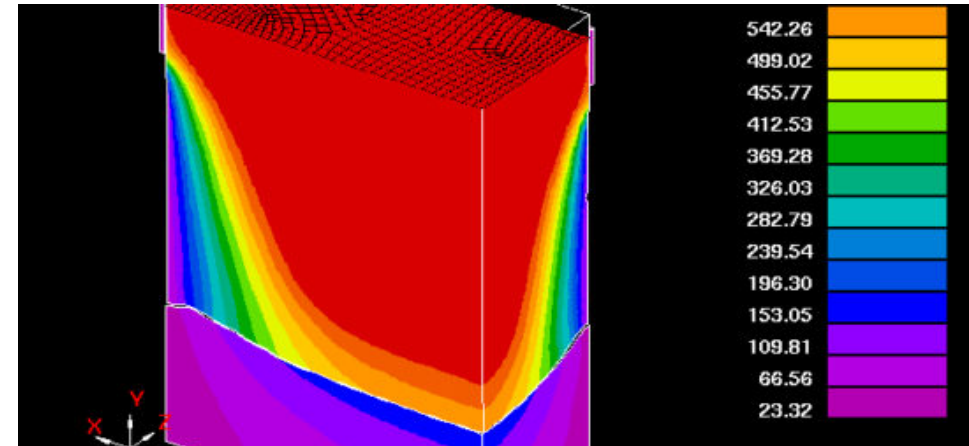
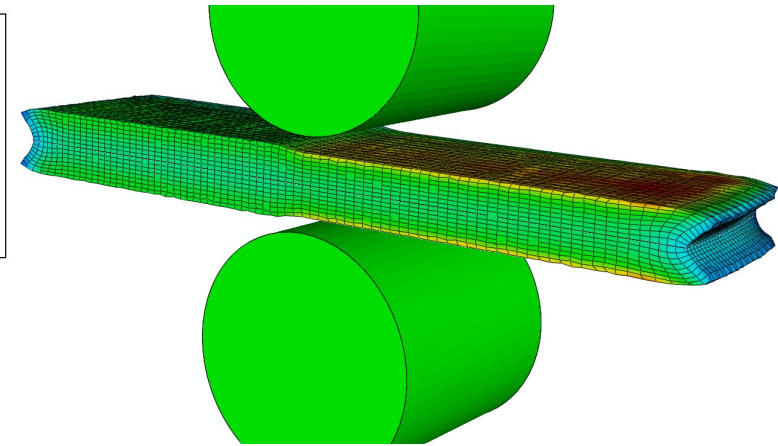
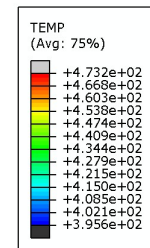
Corrosion Testing

- Secat can perform traditional salt spray, Prohesion, and cyclic automotive tests.
- Fully-adjustable relative humidity and precise control over ramp times.
- Secat can evaluate coating integrity, corrosion rates, as well as the mechanisms of corrosion.
- Testing results are similar to outdoor environments in resulting structure, morphology, and relative corrosion rates.
- Can accommodate full size sheet panels up to 57" wide, numerous small test coupons, and formed components like wheels.



Process Modeling at Secat

- **ABAQUS Modeling Software**
ABAQUS is a finite element modeling program designed for modeling a variety of material behavior in both static and dynamic situations.
- **ProCAST Modeling Software**
ProCAST is a leading finite element solution for casting process simulation.
- **Star CD**
Star CD is a leading finite element solution for furnace and burner modeling and is used for CFD modeling to understand temperature and heat flow in gas fired melting furnaces.
- **JMatPro – Thermo-Calc**
- **Thermodynamic Models** – to predict alloy behavior with variations in chemistry.



Secat's Capabilities - Materials



Alloy and Process Development

Capability to Design Alloys,
Cast and Roll

DC Casting Lab Sized Facility
and Hot Mill

Access to National
Laboratories

Utilize well known retired
consultants



Material Characterization

Tensile

Texture and microstructure

Earing, bend properties

Low cycle fatigue

Conductivity



Plant Data Analysis – to understand statistical relationships



Solution Heat Treatment, Aging and Anneal Studies

Blister Testing

Strength Testing post Heat
Treatment

Hardness Studies

Secat's Capabilities - Process



Molten Metal Quality – Metal Cleanliness & Hydrogen Content

Metal Cleanliness
Hydrogen Content



Failure Analysis

End user issues
Plant issues and
problems



Troubleshooting to identify problems and provide solutions

In-plant problem
solving and on-site
expert support



Coordinate tests with other laboratories

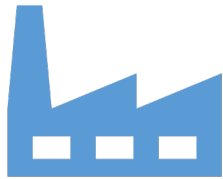
Surface Roughness
Slip Resistance
Trace Elements –
Chemistry
Corrosion Tests



Product and Process Modeling

Thermocalc/JMat Pro
ABAQUS
ProCAST
StarCD

Secat's Capabilities - Training



Identification of Plant Metallurgists

Recruitment
Training at Customer Facility and Secat Laboratory
Placement at Customer Facility



Basic Casting Classes

Aluminum Wrap Up – 101 – Bauxite to End Product

- Tailored to customer needs

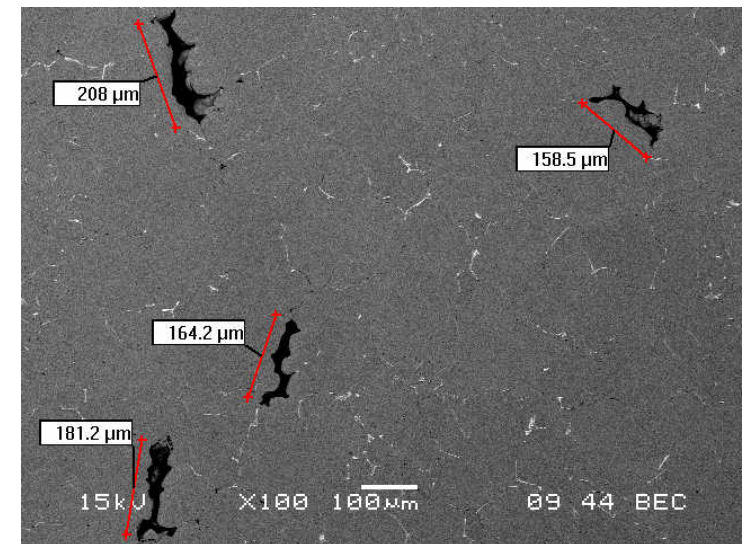
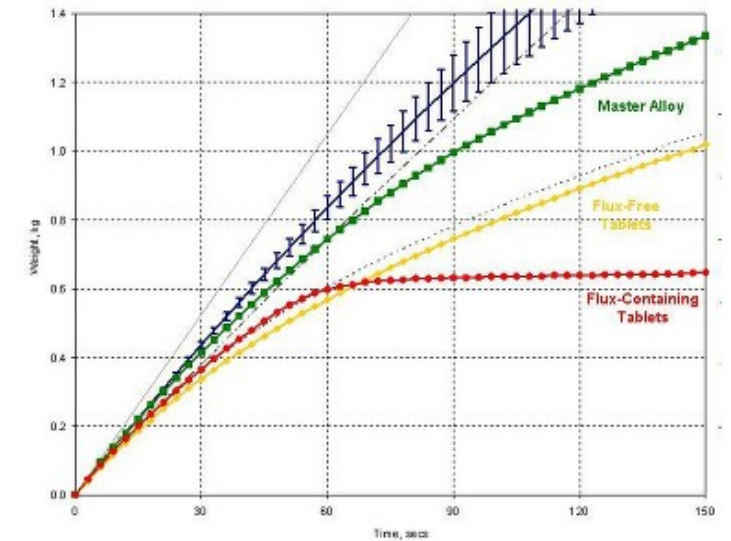
Metal Evaluation: Interpret Micrographs and EDS/SEM Data

- Secat Lab Training

Aluminum Billet Casting Course
Aluminum Extrusion Course

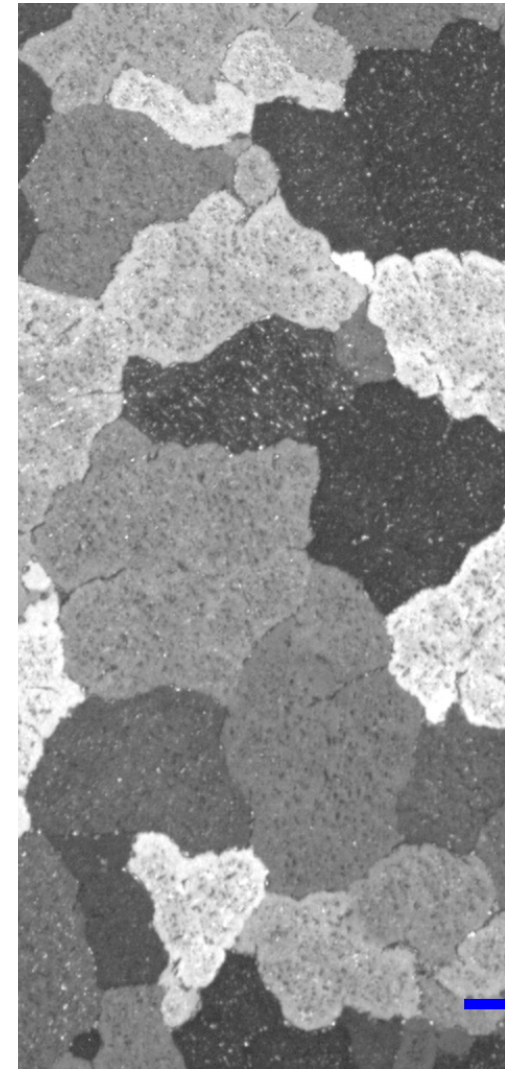
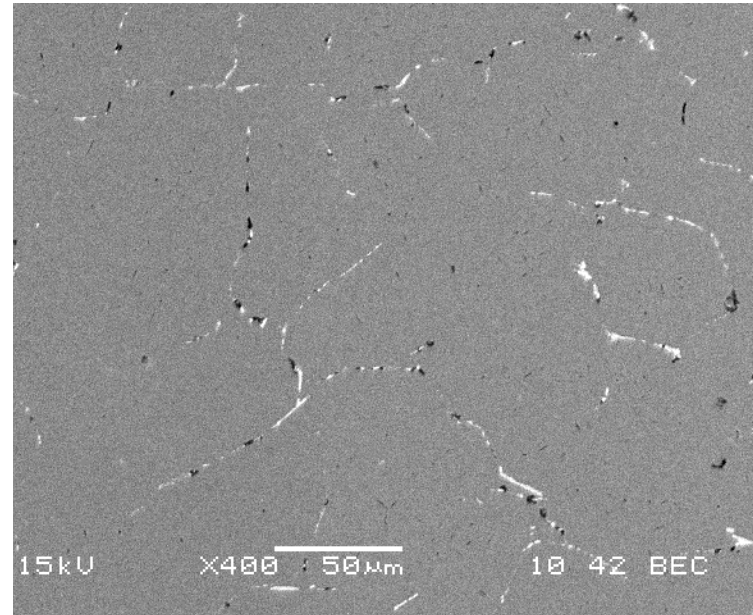
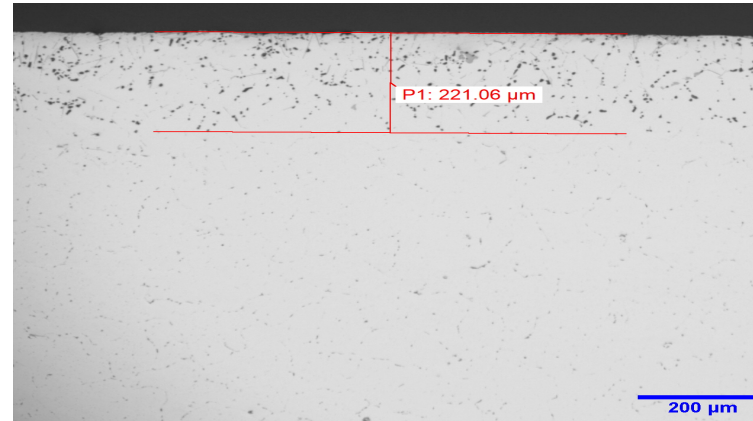
Secat's Expertise - Casthouse

- Ingots – microstructure characterization
- Homogenization Trials with Differential Scanning Spectrometry
- J Mat Pro & Thermo-Calc
 - Thermodynamic Calculations for New Chemistry
- Prefil Metal Quality and Alscan Hydrogen Tests
- Solidification and Ingot Cooling Models – ProCAST
- Furnace Models – Star CD
- Dross – XRD Characterization



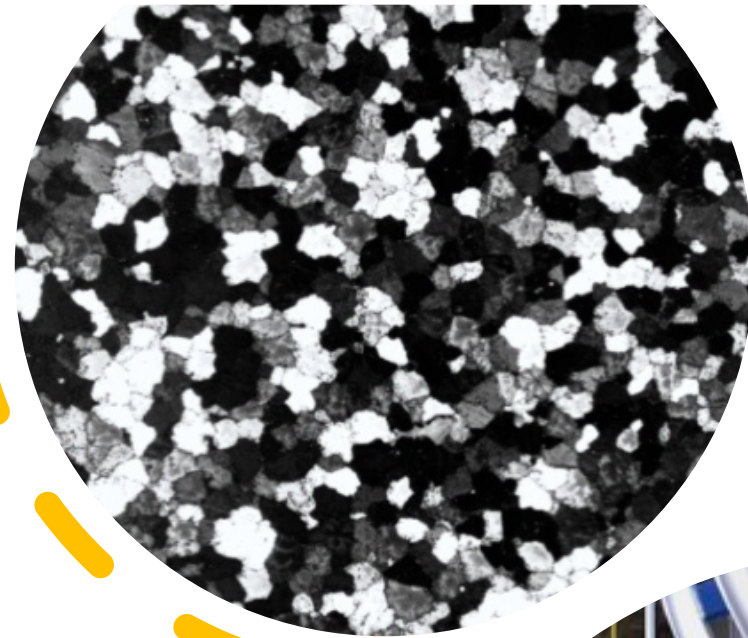
Secat's Expertise – Billet Evaluation

- Inverse segregation zone measurement
- Grain size analysis
- Microstructure analysis - SEM & EDS
- Chemistry – Optical Emission Spectrometer
- Inclusions and defects
- Porosity



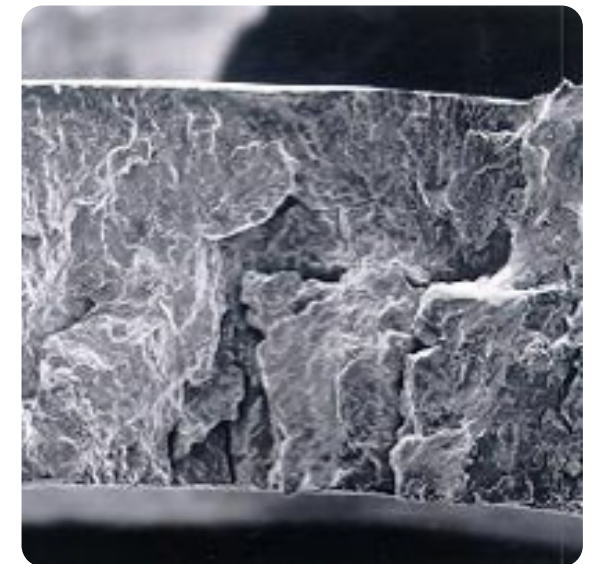
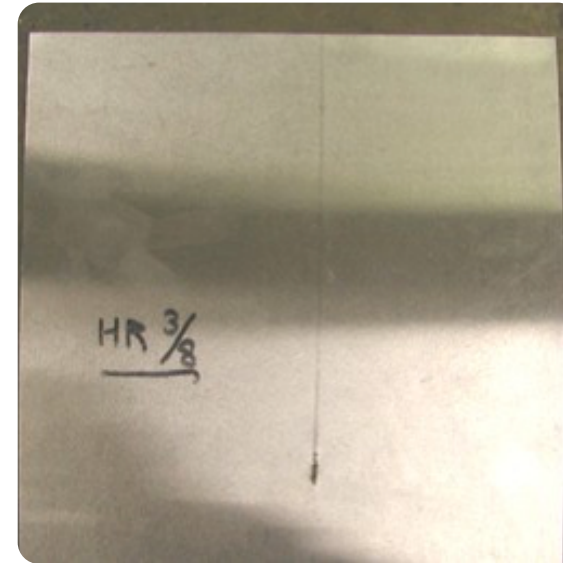
Secat's Expertise - Rolling Mill

- Microstructure characterization
- Material properties – tensile, corrosion tests
- Assist in trouble shooting production issues related to quality
 - Determine root cause and provide solutions
- Trouble shoot in house issues to determine cause and solutions
 - Microstructure
- Tensile
- Texture
- Failure analysis – sheet defects
- Lab Trials and development of improved processing techniques
 - SHT and Aging
 - Rolling Trials and HT
 - Model Rolling Practice



Secat's Expertise - Final Product

- Microstructure characterization
- Material properties – tensile, forming limit diagrams, corrosion tests
- Assist in trouble shooting production issues related to quality
 - Determine root cause and provide solutions
- Trouble shoot customer issues to determine cause and solutions
 - Microstructure
 - Tensile
 - Failure analysis – sheet defects
 - Corrosion Tests
 - Texture
- Residual Stress Measurements
- Lab Trials and development of improved processing techniques
 - SHT and Aging
 - Rolling Trials and HT
 - Model Stretch/Aluminum Parts – Abaqus
- Literature Survey



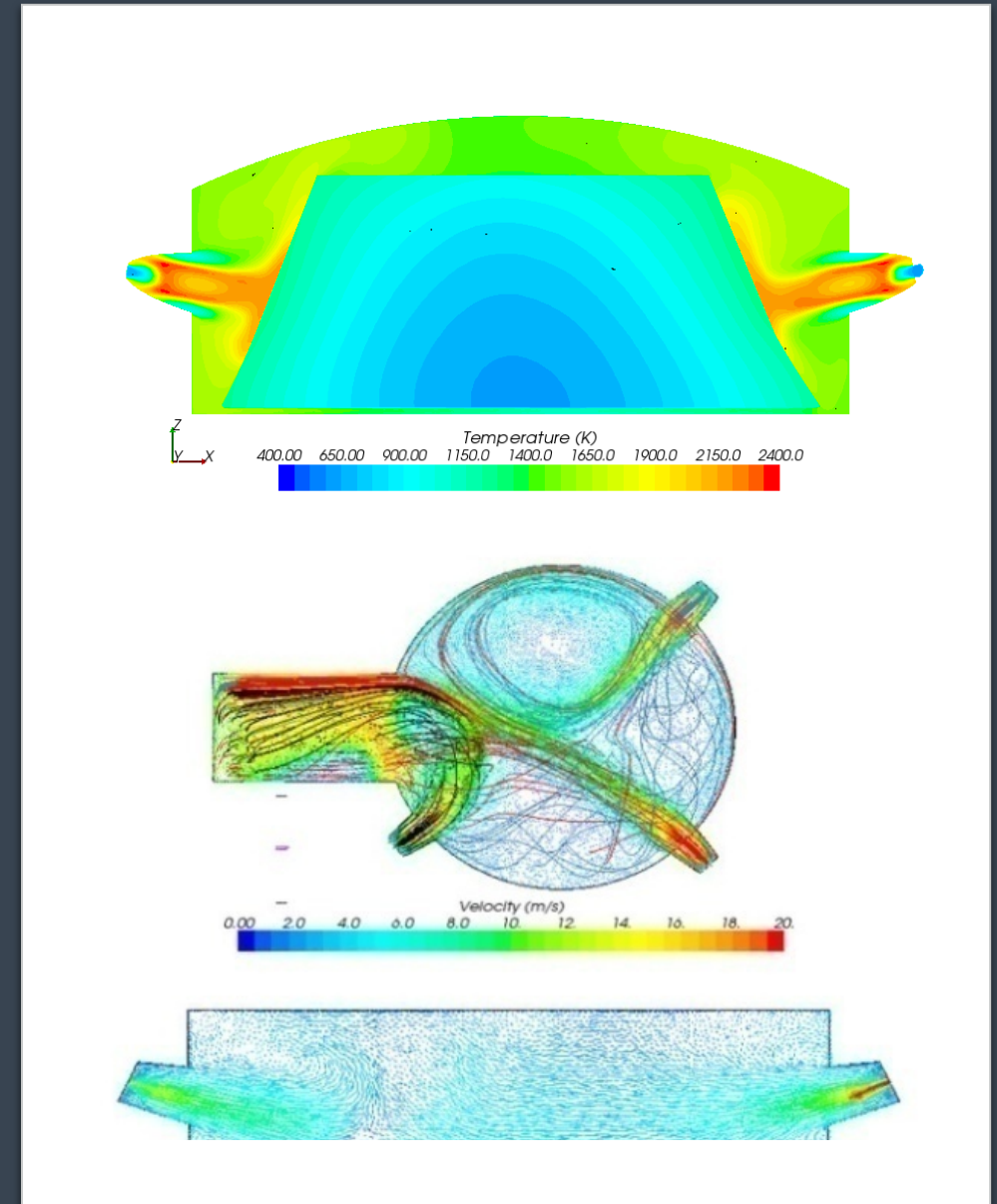
Secat's Expertise – Beverage Container Analysis

- Can/End/Tab Stock – Sheet and End Product
- Cast Slugs – Containers
- Quality Control and Assurance – as per customer standards
 - Microstructure characterization
 - Material properties
 - Assist in trouble shooting production issues related to quality – tear off, pinhole etc.
 - Determine root cause and provide solutions
 - Trouble shooting customer end problems to determine cause and solutions
 - Microstructure, tensile and failure analysis
- Lab Trials and development of improved processing techniques



Secat's Expertise – Energy and Furnace Study

- Energy Assessments
 - Site assessments of furnaces – Infra Red Camera/Gas Analyzers
 - Furnace design and process optimization by modelling
- Scrap Evaluation
 - Dross and % Aluminum Present
 - Volatiles Present in Castings
 - Laboratory Trials on Melting Scrap and Evaluating Recovery





Thank you