THERCAST®

SIMULATION SOFTWARE FOR METAL CASTING AND SOLIDIFICATION

POWERFUL
RELIABLE
EXTENSIVE
EFFECTIVE

Your strategic partner for the development of high added value cast components

LEADING EDGE SOLUTIONS FOR VIRTUAL MANUFACTURING

TRANSVALOR

SIMULATION BECOMES A REAL LEVER OF COMPETITIVENESS

THERCAST® OFFERS YOU A CONCRETE SOLUTION IN RESPONSE TO YOUR NEEDS

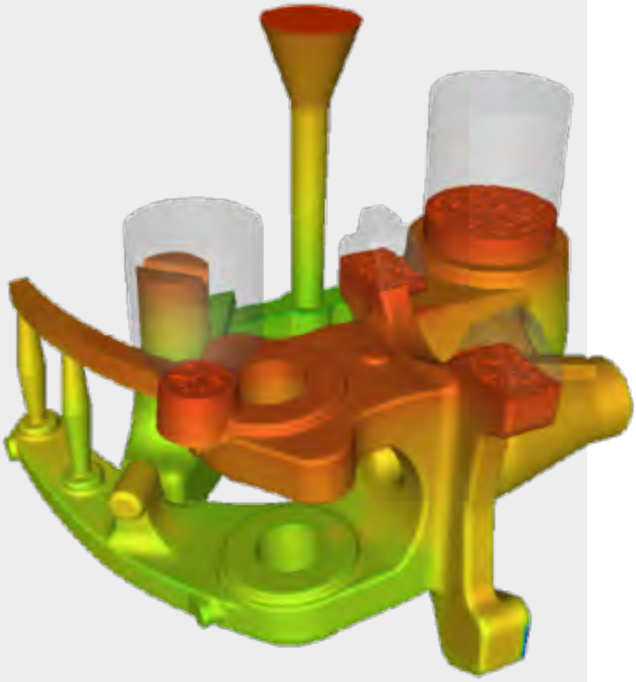
In extremely competitive and ever-changing markets, simulation is now an essential step in the development cycle of high-value cast parts.

THERCAST® is a powerful and comprehensive application that allows you to quickly and accurately analyze your manufacturing process, from the initial casting to the end of solidification. Thus, you anticipate manufacturing defects allowing you to produce high-quality components and reduce the prototyping phase.

The result is faster time to market and lower production costs.

WITH THERCAST® SOFTWARE, YOU CAN:

- Control your manufacturing processes thanks to a better understanding of physical phenomena
- Guarantee part feasibility
- Offer innovative and differentiating products
- Limit non-quality costs by upstream detection of casting defects
- Make rational engineering choices that meet the needs expressed by the customer
- Adopt a continuous improvement approach by optimizing existing productions
- Meet your customers' cast part quality and performance requirements
- Capitalize your know-how within the company



SIGNIFICANT BENEFITS AT MULTIPLE STAGES OF YOUR ACTIVITY

- In R&D phase, develop innovative or complex product
- In quotation phase, position yourself more quickly
- In design or process development phase, reduce time to market
- In production phase, control manufacturing costs

SOFTWARE ADAPTED TO ALL CASTING TECHNOLOGIES

THERCAST® and its modular offer will provide you with valuable support for ingot casting, foundry casting and continuous casting.

CENTRIFUGAL CASTING

LOW PRESSURE DIE CASTING

SAND CASTING

CONTINUOUS CASTING

HIGH PRESSURE DIE CASTING

INVESTMENT CASTING

INGOT CASTING

SHELL GRAVITY DIE CASTING

TILT CASTING

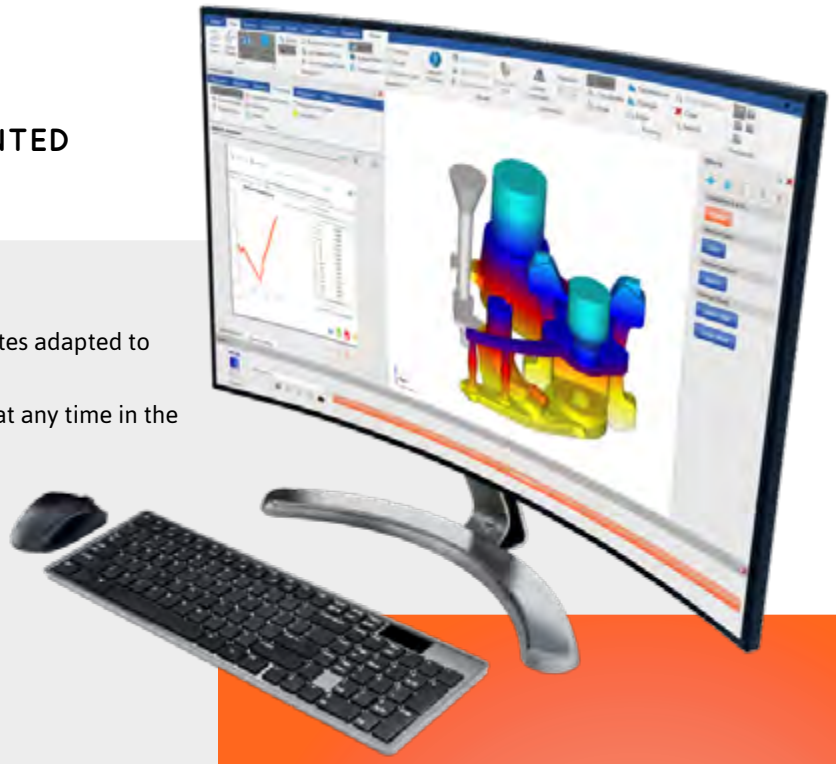
PREDICTIVE FOR ALL ALLOY TYPES

THERCAST® is supplied with a large database with multiple references for castings but also inserts, permanent or non-permanent casting molds, exothermic powders, coatings, refractories materials, etc. Most metal alloys are available: gray iron, ductile cast iron, steel, copper alloys, aluminum alloys, etc.

For specific materials, we recommend using JMatPro® software that allows you to export all the material data needed for calculation directly to THERCAST® format.

ALUMINIUM CARTER

UPGRADE TO A MULTILINGUAL GRAPHICAL INTERFACE AND ENJOY A 100% BUSINESS-ORIENTED EXPERIENCE

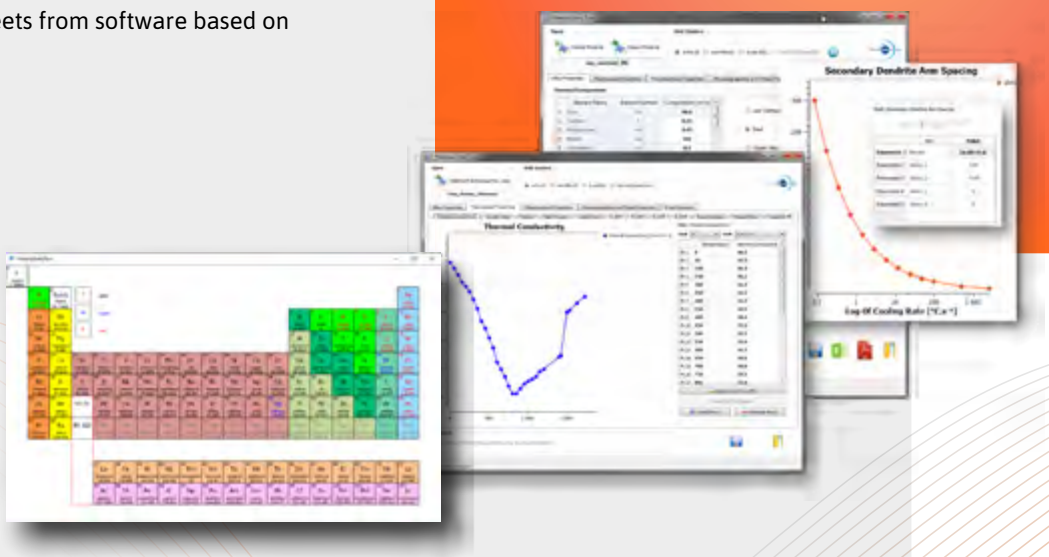


- Benefit from customizable simulation templates adapted to each casting technology
- Perform your data setup or view your results at any time in the same interface
- Simulate filling and solidification in a single calculation
- Take advantage of 'multi-view mode' to easily compare different casting processes
- Track points and particles

AN EFFECTIVE AND INTUITIVE USER EXPERIENCE

A GRAPHICAL MODULE DEDICATED TO MATERIAL SPECIFICATIONS

- Represent the thermo-physical data and the behavior laws
- Manually adjust the material parameter curves directly on the graph
- Use the periodic table of elements to create the macro-microsegregation data for your custom alloy
- Import material datasheets from software based on the CALPHAD method



VIEW MOBILE MOLD ELEMENT KINEMATICS

- For configurations with cycling, THERCAST® represents the programmed kinematics for each mold element to verify sequencing and consistency with the actual process
- In tilt casting, the user checks the intended rotational movement of the mold at the start of casting
- In centrifugal casting, the user checks the rotational movement defined for the entire mold

INTEROPERABILITY WITH CAD SYSTEMS AND OTHER FINITE ELEMENT COMPUTATION SOFTWARE

- Exchange format support (Parasolid, STL, STEP, UNV, etc.)
- Native format support (Catia v5, Creo Parametric, NX Siemens) with the CADdoctor Transvalor Edition option
- Import all constituents of the casting system via a global assembly file (STEP or Parasolid)
- Export THERCAST® to FORGE® to monitor porosities and segregations during subsequent forging or rolling operations
- Export THERCAST® to the finite element software of your choice to calculate service life

SIMPLE, RAPID AND EFFICIENT INTERPRETATION OF RESULTS

With THERCAST®, enjoy features that facilitate analysis, interpretation and dissemination of results:

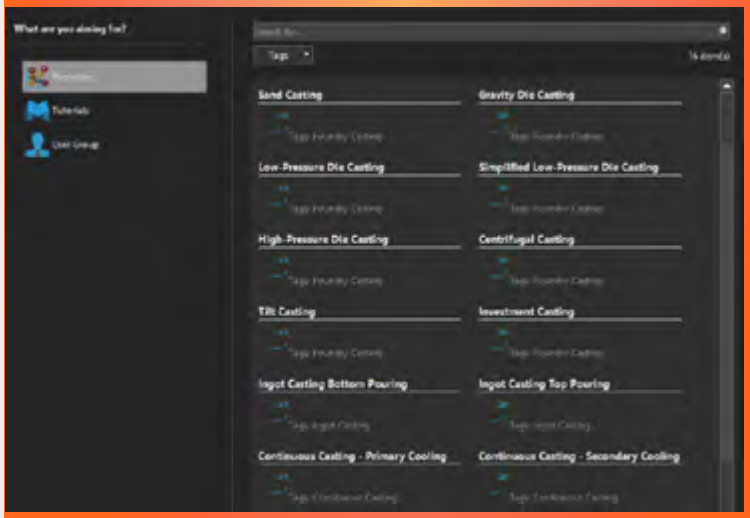
- Use 'Custom Actions' to display in a single click your most important or most common results (e.g. metal front, porosity, etc.)
- Save your workspace to obtain the same visual environment next time you run the software
- Opt for 'Macro Mode' to easily record and repeat sequences of actions
- Distribute your main results using the automatic report generator (Word or PowerPoint format)
- With the 'One Click Share' feature, you can share a selection of simulation results with your colleagues or customers via a dedicated Cloud

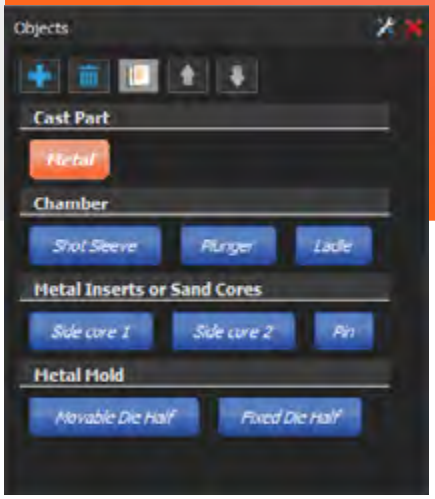
AN APPLICATION PERFECTLY ADAPTED TO YOUR BUSINESS

THERCAST® offers a multilingual graphical interface and a business-oriented work environment. THERCAST® includes simulation templates with object lists or predefined process parameters.

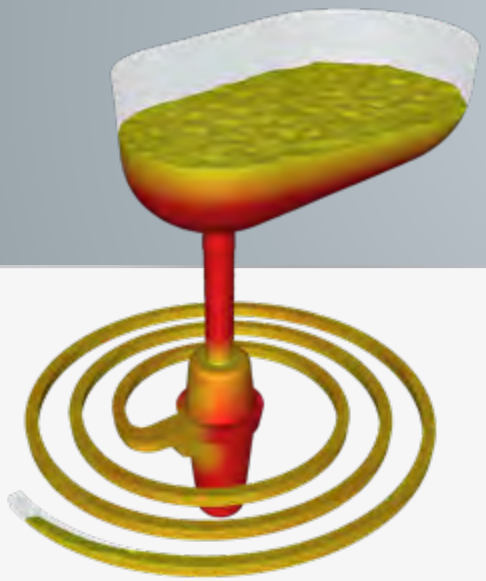
You can customize these models to fit your fabrications and your in-house terminology.

Thus, the setup and result analysis steps are greatly facilitated.



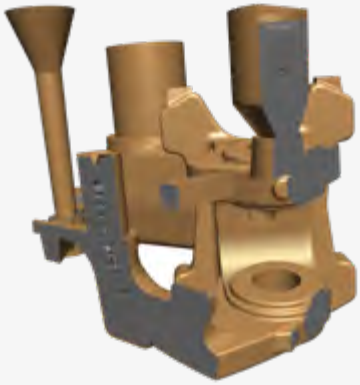


ACT
TO ELIMINATE RISKS



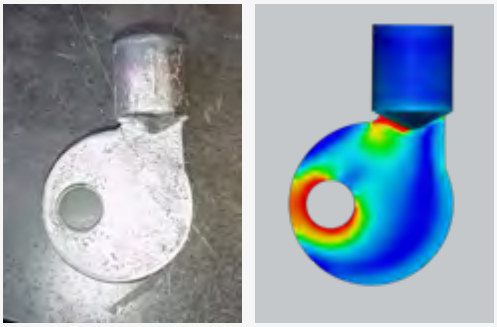
ANTICIPATE MISRUNS AND INCOMPLETE DIE FILLING

THERCAST® predicts slowing or stoppage of metal flow should it occur during the process. Thus, misruns and incomplete die filling can be avoided.



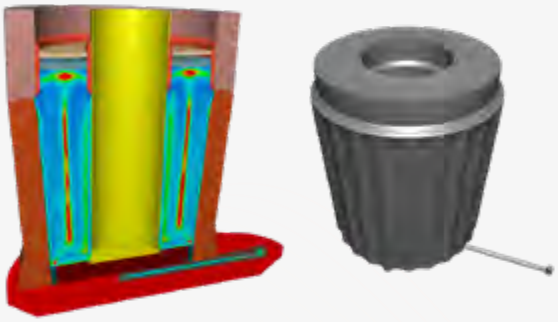
PREVENT SHRINKAGE

THERCAST® specifically indicates the presence of primary or secondary shrinkage occurring during solidification. Internal shrinkage can affect the strength of the part and pose potential risks to finishing operations.



PREVENTING HOT TEARS AND CRACKS

THERCAST® incorporates Won and Yamanaka criteria when resolving calculations to identify the risks of hot tearing or cracks.



ANTICIPATING THE PRESENCE OF POROSITIES

THERCAST® accurately detects all defective areas in terms of macro or microporosity associated with segregation phenomena.

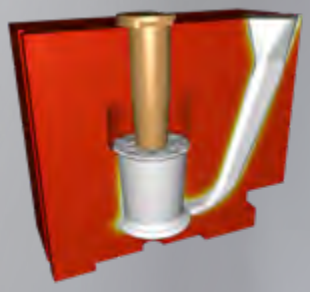
THERCAST® GUARANTEES RELIABLE AND PRECISE RESULTS

- Shrinkage porosity
- Open shrinkage (pipe, caved surface)
- Hotspots
- Cracks
- Air entrapment
- Oxides entrainment
- Hot tearings
- Ghost lines
- Misruns and cold shuts
- Porosities
- Microsegregations
- Grain growth and orientation

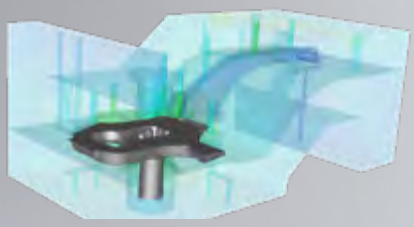
A COMPLETE SOLUTION FOR FOUNDRY CASTING

> We have been successfully using THERCAST® software for many years for our higher education activities. All processes are regularly simulated (sand gravity casting, shell casting, low & high pressure die casting). Our developments with industrial partners have made it possible to appreciate the ability of the software to accurately simulate the deformation and stresses occurring in the cores and in the molds during casting.
>
> *Fabien Lanicot, Foundry teacher, Lycée Hector Guimard, France*

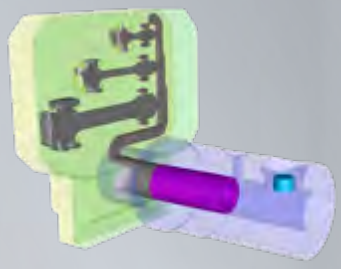
As in the workshop, you can act on all the process levers: coatings, cycle times, control of moving part closures, rockers, stopper rods, etc. THERCAST® is also a great tool to improve gating systems and optimize feeders.



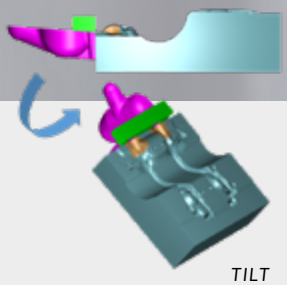
GRAVITY SAND/SHELL CASTING



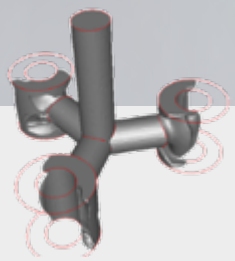
LOW PRESSURE DIE CASTING



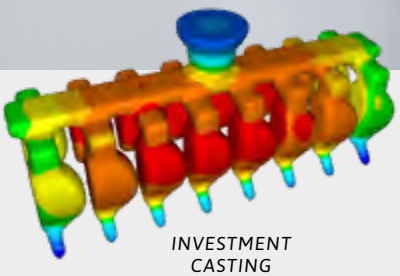
HIGH PRESSURE DIE CASTING



TILT CASTING



CENTRIFUGAL CASTING



INVESTMENT CASTING

THERCAST®, A TOOL FOR INNOVATING

- Create innovative ranges of lighter cast parts with the guarantee of flow representation true to the reality of the processes
- Anticipate macroscopic defects such as shrinkage porosities, pipes, caved surfaces, piercing or misruns
- Size and test the positioning of feeders, control channels and cartridge heaters
- Track particle and inclusion movements
- Predict rheological phenomena such as A and V segregation, solid phase distribution, porosities or residual stresses
- Simulate mold warm-up

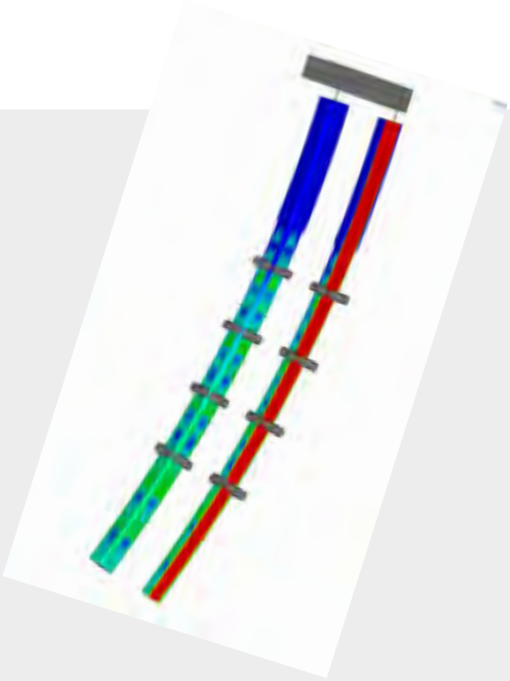
YOUR KEY ADVANTAGES FOR CASTINGS

- A 'Fill and Solidification' simulation carried out at any time with a single software application: 'Fluid Mechanics' and 'Solid Mechanics' calculations are fully integrated
- Accurate representation of process parameters (coating, stopper rod action, solidification well, foundry filter, feeder position, etc.)
- In investment casting, THERCAST® makes it easy to create the shell around the cluster and to simulate thermal behavior with self-radiation

> Thanks to THERCAST® software, we were able to provide our client with a validated technical solution, thereby reassuring them on their technological choices.

Antoine Bally, Research Engineer, ABS Metallurgical Center, France

FOR CONTINUOUS CASTING



A TRUE VISUALIZATION OF REALITY

THERCAST® integrates liquid/solid thermomechanical coupling involved in material transformation.

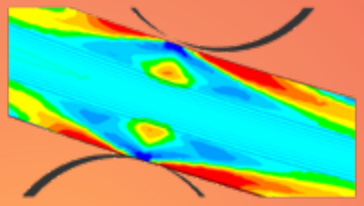
With this implementation, you can study all types of phenomena: ladle and tundish flow, primary and secondary cooling, deformation in contact with rollers and spray-induced cooling.

A BUSINESS-ORIENTED INTERFACE TO DEFINE THE CONTINUOUS CASTER

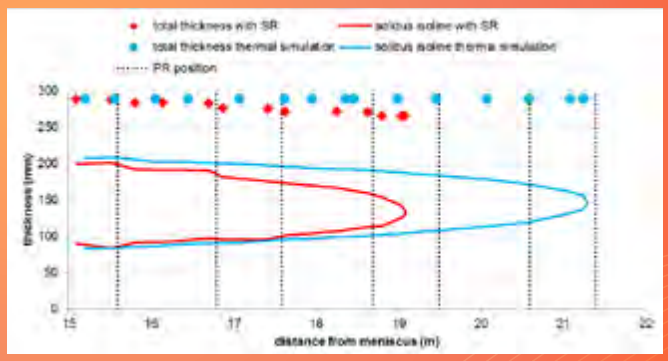
THERCAST® incorporates a dedicated interface showing all the parameters of your continuous casting machine. This allows you to digitally translate the geometry and parameters of the machine (inputs, rollers, sprays, etc.).

SOFT REDUCTION: A MAJOR EFFECT

Thanks to its specific feature for taking soft reduction into account, THERCAST® allows the impact of pinch rollers on the cast product to be analyzed. You can thus optimize not only the positioning of the straightening areas, but also roller management for better control of product quality via the position of the liquid well and the size of the porosities.



VISUALIZATION OF THE IMPACT OF THE ROLLERS ON THE END OF THE LIQUID WELL

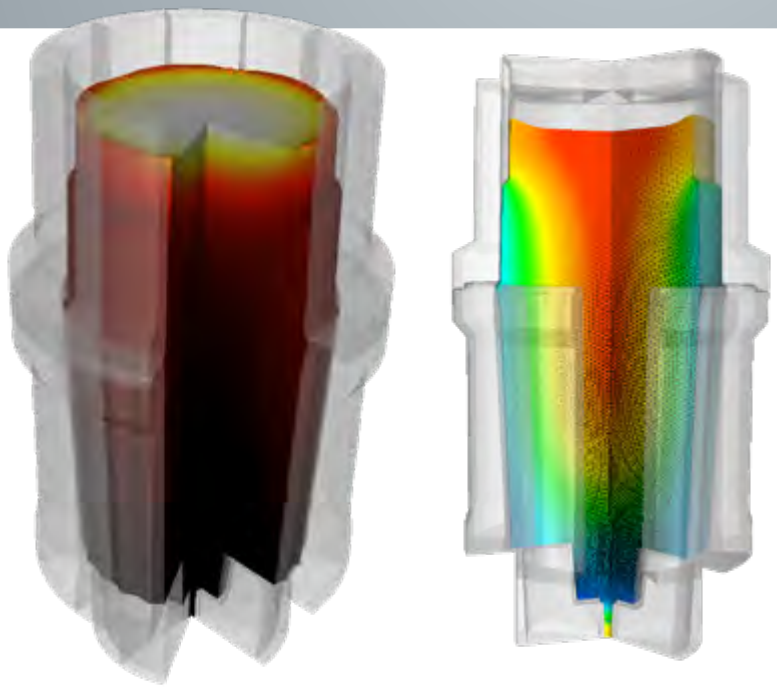


KEY ADVANTAGES TO OUTPERFORM YOUR COMPETITION

- Calculation 'by slice' to reduce computation time
- For fine analysis, a complete thermo-mechanical calculation over the entire metallurgical length
- Control of the liquid fraction zone and the position of the liquid well
- Anticipation of solidified thickness in primary and secondary cooling areas to avoid bulging defects or risks of piercing
- Assessment of the rate of deformation required to ensure the sealing of porosities
- For a better understanding of defects, the calculation of 'fluid mechanics' and 'solid mechanics ' is coupled

> Striving to continually improve the quality of its products, Industeel has used THERCAST® from the outset, to cast its ingots while taking into account every aspect relating to emptying the ladle, filling the ingot mold, right out to when the metal solidifies and cools.
>
> *Isabelle Poitrault, Industrial process manager, ArcelorMittal, Industeel, France*

FOR INGOT CASTING



A REALISTIC REPRESENTATION

Suitable for a wide range of ingot cross-sections or masses, THERCAST® simulates ingot bottom or top pouring. The software incorporates a casting filter module and considers all technological factors such as the presence of refractory materials or coating.

THERCAST® also models turbulent flows and manages all interactions between the metal and the wall of the ingot mold, the slag and the mold flux.

For bottom pouring, THERCAST® validates the geometry and dimensions of the feeding system.

EXOTHERMIC POWDER

THERCAST® models exothermic powder and highlights the impact on the slowing of solidification at the top of the ingot.

INTERACTIONS WITH MOLDS

THERCAST® is the ideal solution for preventing risks associated with ingot making. Thanks to part- and mold-coupled thermo-mechanical resolution, THERCAST® can anticipate mold deformation and breakage.

THERCAST® HELPS IMPROVE YOUR COMPETITIVENESS AND OPTIMIZE OVERALL PROCESS EFFICIENCY

- Minimize the costs associated with material losses in the high and low zones of the ingots: THERCAST® optimizes feeder management
- Save prototyping times: THERCAST® models dynamic air gaps associated with solidification shrinkage
- Improve the quality of your ingots: THERCAST® detects defects (shrinkage, distribution of inclusions, porosities, cracks and hot tearings)

TAKE THINGS FURTHER BY STUDYING METALLURGY

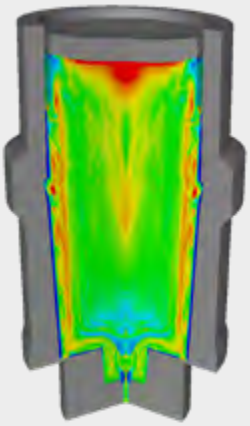
PHASE TRANSFORMATIONS

THERCAST® simulates phase transformations that may occur during solidification. You can thus determine the transformation zones (ferrite, bainite, etc.) occurring during casting.

For steels (carbon and low-alloy steels), the software includes an automatic isothermal diagram generator that calculates transformation curves from the chemical composition or from a CCT diagram.

FEATURES AND BENEFITS

- Predict steel phase transformations based on different models implemented (JMAK, Leblond-Devaux, Li, Koistigen & Marburger)
- Take advantage of the best data sources by importing JMatPro® files
- Access fully integrated solid phase change calculation during filling and solidification
- Analyze mechanical properties (hardness, residual stresses, etc.) related to phase changes and geometric variations (distortions)



INSPECT SEGREGATED ZONES

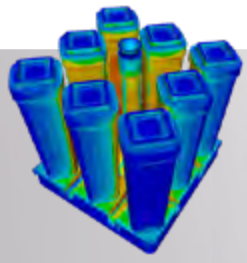
THERCAST® incorporates predictive metallurgical models dealing with microsegregation phenomena that can lead to macrosegregation.

- Use of multi-constituent (Fe/C, Fe/Mn, Fe/Cr) and multi-binary diagrams based on models such as Levers Law, Gulliver-Sheil, Brody-Flemings, etc.)
- Integration of convection loops in the liquid and mushy zone while taking into account mechanical constraints that can lead to positive or negative segregation
- Understand the impact of segregation on the solidification path
- Measure areas of positive or negative segregation for all alloy elements
- Identify A or V segregations, use of Suzuki's criterion

Several ongoing research projects also address the problem of segregations developing in the form of freckles (channel type segregation).

MICROSTRUCTURE AND GRAIN STRUCTURE

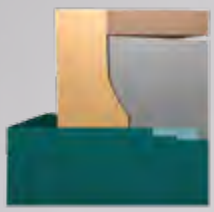
- CAFE (Cellular Automata Finite Element) method grain distribution calculation
- Grain germination and growth
- Representation of grain orientation by pole figure
- Control of the columnar-equiaxed transition zone



SELF-RADIATION PHENOMENA

TAKING SELF-RADIATION PHENOMENA INTO ACCOUNT

THERCAST® takes thermal radiation into account. This phenomenon is particularly significant for investment casting or for cluster casting of small/medium-sized ingot or simply for castings with concave shapes. This is a key element in optimizing your processes.



AIR GAPS PHENOMENA

VIEWING SHRINKAGE PHENOMENA AND THE IMPACT OF AIR GAPS

THERCAST® incorporates scalable contact management to detect any detachment between the cast metal and the mold. As soon as shrinkage appears, the software takes into account the influence of the air gap thus created and locally adapts the heat exchange between the metal and the mold.

COMPETITIVE ADVANTAGES

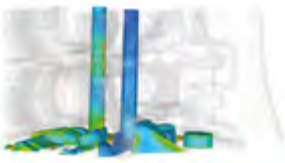
> "Thanks to THERCAST® software, we were able to confidently propose a new ingot geometry to steel mill crews. The characterizations that were done on the product confirmed these predictions."

Joëlle Demurger,
Head of Process Engineering Group
Ascometal, Schmolz+Bickenbach, France

TURBULENT FLOW

SIMULATING TURBULENT FLOW

THERCAST® includes a self-adaptive remeshing solution that improves accuracy and computation time. This feature allows the modeling of turbulent flows but also the accurate detection of defects and their propagation.



STRESS CONCENTRATION IN THE MOLD PINS

IMPROVING MOLD LIFE CYCLE

A one of a kind application, THERCAST® achieves thermomechanical resolution at every moment of the process, coupled both in the part and in the molds. The impact of the molten metal on the molds and inserts is thus perfectly taken into account by the simulation to view the interactions around the mold and its environment (plastic deformations in hot parts of the mold, mechanical strength of the sand cores or inserts, elastic or plastic deformation of the pins, risks of wear by checking in areas of high thermal gradients, sand casting metal penetration phenomena, etc.).

AN END-TO-END SOLUTION FOR THE ENTIRE MANUFACTURING CHAIN

Transvalor offers a wide range of software to simulate the entire manufacturing chain. Start by simulating ingot casting in THERCAST® and continue your analysis in FORGE® to study open-die forging and control the rate of porosity closure. With SIMHEAT® software, you can also simulate heat treatments applied to the castings.

Transvalor's 'End-to-End' solution ensures perfect interoperability between its software applications with simple, fast data transfer and no loss of results accuracy.

THERCAST® A ROBUST AND EFFECTIVE SOLUTION THAT ADAPTS TO YOUR NEEDS

LICENSE MANAGEMENT: LIFT THE TABOOS!

THERCAST® is marketed according to a floating license principle with the use of a maximum number of tokens.

- Determine the licensing scenario that best matches your level of use, along with your IT and budget requirements (permanent license, annual license, cloud license, etc.)
- Adapt your choice of license and token pool on the fly, depending on changes to your teams or your business needs
- The pre- and post-processing modules do not consume tokens. In other words, only calculations will use your token pool
- Manage your token pool as you see fit. For example, a 16-token license allows you to run 4 calculations on 4 cores, or 2 calculations on 8 cores. All combinations are allowed with respect to the maximum number of tokens.

A MODULAR OFFER

To meet the specific needs of our customers, TRANSVALOR offers, in addition to its global offering, a modular offering that allows you to access only those features you really need.

This modularity is also reflected in THERCAST® through several offerings:

- An offer dedicated to continuous casting
- An offer dedicated to foundry casting and ingot casting
- An 'all-inclusive' offer

FOR ACADEMIC USE OR FOR YOUR RESEARCH PROJECTS

Thanks to the principle of user routines, the user has great flexibility to program new laws of evolution.

It is thus possible to implement one's own models as behavior laws, friction laws, or damage criteria.

You can also benefit from preferential conditions thanks to our academic program.

FLEXIBILITY AND COMFORT OF US

Use THERCAST® where, when and how you want:

- No limit on the number of users
- Pricing independent of the number of users; no additional costs if your team should grow
- Simply access the license server installed on your corporate network, or locally on your computer
- Run the software on any type of hardware architecture (laptop, workstation, server and cluster) in 'standalone' or 'client/server' mode
- Collaborative work: compatible with queue managers
- View and share your results free of charge between employees, or with your customers thanks to the 'One Click Share' interactive solution
- Access your data updates and analyze your calculation results at any time even if your license has expired.
- Share automatic calculation reports with your co-workers and customers

OUR PRIORITY IS TO BE AT YOUR SERVICE AND ACCOMPANY YOU ON A DAILY BASIS

From computer consulting to the most complex studies, Transvalor assists you in the context of engineering services.

EXPERTISE AND CONSULTING

- You are faced with a new technical problem...
- You cannot devote the necessary time...
- You are faced with a loss of know-how due to the departure of employees...
- You have difficulties recruiting your new talent...

Consult our experts who will propose technical solutions adapted to your needs, combining knowledge of engineering and latest generation calculation means.

SOME SPECIFIC STUDY EXAMPLES

- Prediction of crack defects on large steel parts
- Optimization of cooling systems and straightening zones in continuous casting
- Calculation of casting gating systems and feeders to minimize defects
- Analysis of feeding systems for cluster casting of ingots

TECHNICAL SUPPORT

A project does not stop when production starts. Our Technical Support team (Level 1, Level 2 and Expert) is here to help you and make the most of our solutions.

- Multilingual support (English, French, German, Spanish) open all year round on business days
- Team of engineers specializing in digital simulation, processes and materials
- Ticket resolution monitoring via your personal space on the customer portal
- Remote control for greater efficiency
- Access to newsletters
- Ability to submit upgrade requests
- Access to new versions and patches for the current version

Regularly updated online help

- Advice to your IT departments for hardware configurations and software installation.

TRAINING

Transvalor is approved Training Organization and assists you in training your teams, cultivating your know-how, supporting your technological changes and, ultimately, increasing your competitiveness.

Choose your formula from a panel of proposed themes: tailor-made, in groups or individually, for beginners or experts, in French, in English or in German, etc.

Almost anything is possible for you to achieve your performance goals.

> "A support system that assists you in solving your problems from start to finish is more than just an accident. This is a fundamental principle of Transvalor"

Dave Fournie, Technology Process Director, Gerdau, USA

TRANSVALOR
ABOUT US

Transvalor is a French company, founded in 1984, with its headquarters in the Sophia Antipolis technology park in the south of France.

Transvalor maintains close ties with the Center for Material Forming (CEMEF-Mines ParisTech). This partnership brings a steady stream of scientific developments for the benefit of its customers.

Transvalor is above all a multicultural team bringing together people who are passionate about cutting-edge technology and driven by a desire for innovation.

OUR WORLDWIDE PRESENCE

Transvalor has a strong network of distributors and salespeople operating throughout Europe and Asia.
Its Transvalor Americas subsidiary, located in Chicago (Illinois, USA) completes the system with commercial and technical presence on the American continent.

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ISO 9001:2015
BUREAU VERITAS Certification

TRANSVALOR S.A. IS ISO 9001 CERTIFIED BY BUREAU VERITAS IN THE CONTEXT OF ITS BUSINESS OF DEVELOPMENT, INDUSTRIALIZATION AND MARKETING OF SCIENTIFIC COMPUTATION SOFTWARE AND ASSOCIATED SERVICES. THIS CERTIFICATION STRESSES TRANSVALOR SA'S DETERMINATION TO ADOPT A CONTINUOUS IMPROVEMENT POLICY TO ALWAYS BETTER MEET THE EXPECTATIONS OF ITS CUSTOMERS.

LEADING EDGE SOLUTIONS FOR VIRTUAL MANUFACTURING

TRANSVALOR