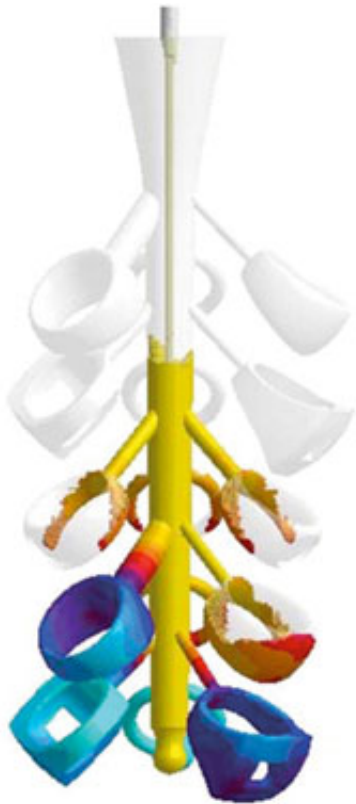


X-RAY EYES FOR JEWELLERY CASTING

Defect prevention assisted by computer simulation of jewelry investment casting



In a lot of areas of areas of application, computer simulation of the investment casting process in advance to a first casting trial in production has become reality since long time already. Especially in the automotive and construction industry, due to increasing cost and time pressure in development and production, simulation has replaced the trial & error approach completely. There is no lack in high quality casting simulation software as well as of corresponding service institutions – as long as gear components or comparable parts are concerned. The casting equipment manufacturer INDUTHERM is now making available this technology also for the jewellery industry and will offer casting simulation as a service aiming at higher production efficiency in jewellery casting.

In the framework of several research projects targeting at improvements of the jewellery casting process, in which INDUTHERM together with other enterprises and research institutions were involved, computer simulation of the jewellery casting process proved to be a most effective tool for failure analysis and especially defect prevention. Due to the combination of longstanding process know-how from casting equipment development, the experience from R&D projects and one of the former research partners now belonging to the team (Dr.

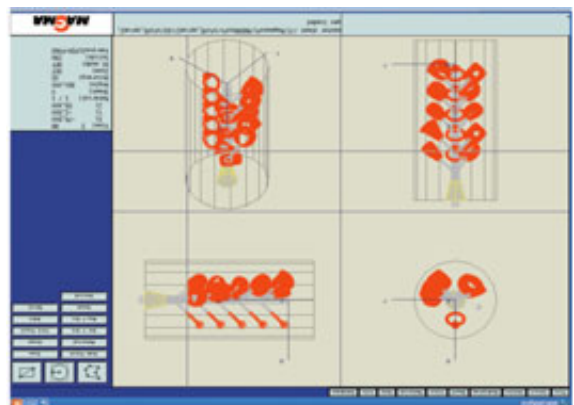
Fischer-Buehner), INDUTHERM is best qualified for the task of a service provider in simulation of jewellery casting: for real improvements of casting results not only the entire control of the complex simulation software is crucial, but also an overall understanding of the interrelationships in real world casting, the equipment parameters, the specific demands of the jewellery manufacturing industry etc.



Dr. Jörg Fischer-Buehner and Peter Hofmann, Indutherm GmbH, are presenting the casting simulation

How does it work?

- CAD-data of the jewelry pattern of interest need to be available and to be supplied by the casting company!
- The sprue system is drawn in a CAD-environment, and combined with the imported jewelry pattern CAD data: a virtual tree results. Furthermore the geometry of the flask is added. (Figure 1).
- The complete set of data then is transformed by software modules into a volume model, sometimes consisting of millions of tiny volume elements.

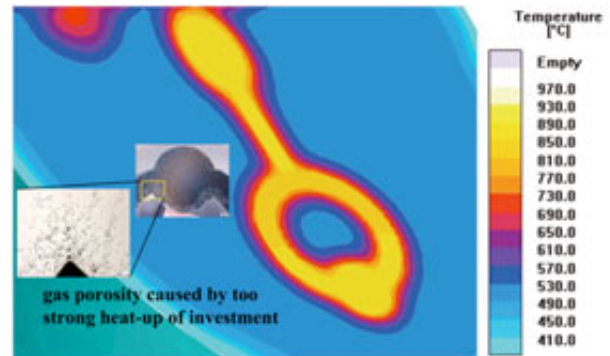


- Physical material property data for the particular alloy and investment material are selected from a database.
- Process parameters like casting temperature and flask temperature are defined and the simulation is started. Depending on the PC, software and the complexity of the problem, a simulation run usually takes several hours.
- Results are analyzed and a 2nd or 3rd simulation run is started to identify optimum casting process parameters or an optimum sprue design

What are the outcomes?

The metal flow, turbulences and temperatures during filling of the mould are visualized as if the inside of the flask is observed with x-ray eyes (Figure 2). Defects like poor form-filling or those caused by investment erosion due to turbulent flow can be tackled.

The simulation of the cooling and solidification process predicts regions with shrinkage porosity (Figure 3). Multiple variations of e.g. the feed-sprue diameter and position are easily realized in the simulation together with process parameter variations and assist in identifying optimum conditions.



Also the investment material is part of the simulation. The heat-up of the investment near to the pattern is analyzed which hints at critical conditions for gas porosity caused by thermal degradation and decomposition of the investment.

The benefit for the customer: saving time, saving money, winning competence and safety

The overall benefit is to predict casting results and defects in a reliable way. Together with the still invaluable experience of a skilled caster, this allows for reduction of expensive and time-consuming trial & error phases in jewelry production. Problematic issues are identified before efforts on the first real casting and the first gram of precious metal are spent. It is expected that these advantages easily level off the costs for computer simulation.

** Results have been worked out in a collaborative research project coordinated by FEM, Schwäbisch Gmünd (D). Realized with MAGMASOFT simulation software.*