

Industrial Technologies Program

Mechanical Performance of Dies

To date, only two groups in the world have addressed the mechanical performance of the die and machine system in die casting. One of the groups is OSU, the General Motors Technical Center when they developed the DieCas software. Only these two groups have looked at the fundamental principles that underlie the behavior of the die in response to the machine clamping forces and the other loads that are present. Perhaps because only high pressure processes are impacted by these additional loads, the problems are far less widely studied than thermal and fill related issues for casting processes. More research is needed before metalcasters fully understand the phenomena and know how to properly design the die/machine system to withstand the loads and maintain the very high degree of precision required in castings.

Further research on understanding the emerging principles and knowing how to best apply them is key to improve dimensional control and operational efficiency. Flash and related alignment problems are major sources of energy-wasting cycle interruptions in die casting, and knowing how to eliminate them will result in a much more energy-efficient process.

Researchers at Ohio State University are leading the way in developing modeling capabilities that provide greater details about the material properties of the casting. For die castings and related processes, this means developing the capability to properly account for the effects of pressure during solidification. This, in turn, requires the ability to account for the degree to which the die maintains a pressure-tight environment.

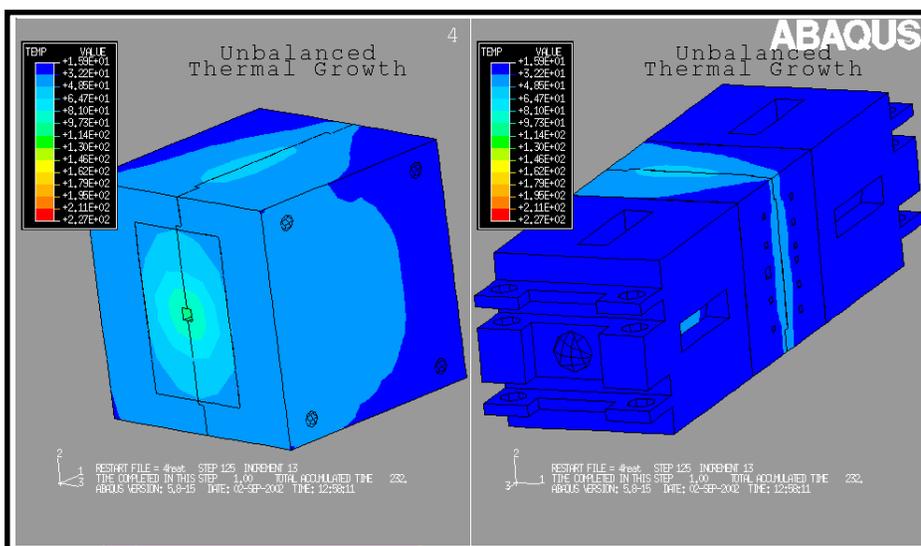


Benefits for Our Industry and Our Nation

- *Improved Dimensional Control*
- *Machines will be able to attain a higher degree of precision in casting*

Applications in Our Nation's Industry

This research will establish guidelines for properly designed die/machine systems that can withstand the loads required and maintain the very high degree of precision in the casting. This research will enable the die casting industry to improve dimensional control and operational efficiency.



Thermal Imbalance in a Zinc Die Casting Die. Thermal imbalance is one of the factors that contribute to unbalanced loads (and die failures), dimensional problems, and high scrap rates.

Project Description

The project has four main objectives:

- Extend the mechanical modeling work to address hot chamber die casting systems.
- Systematically address design of the ejector side of the die.
- Develop parametric information about the relationship between die shoe design, slide carrier design, and the machine.
- Continue the efforts to provide design guidelines for the industry addressing the mechanical design of dies and the relationship between die and machine.

Milestones

The milestones for this project are:

1. Ejector Slide Design Issues
2. Model Framework Development
3. Design Computational Experiment
4. Perform Computational Experiment
5. Model Hot Chambers System
6. Model Framework Development
7. Design Computational Experiment
8. Perform Computational Experiment
9. Slide Design Issues
10. Model Framework Development
11. Design Computational Experiment
12. Perform Computational Experiment

Project Partners

Ohio State University
Columbus, OH

North American Die Casting Association, Wheeling, IL

Cast Metals Coalition Partnership
Charleston, SC

AMCAN
Burlington, Ontario

Exco Engineering
Newmarket, Ontario

General Motors
Bedford, IN

Ried & Assoc.
Portage, MI

Ryobi Die Casting, Inc.
Shelbyville, IN

St. Clair Die Casting
St. Clair, MO

Walkington Engineering, Inc.
Cottage Grove, WI

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy
Energy Efficiency
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