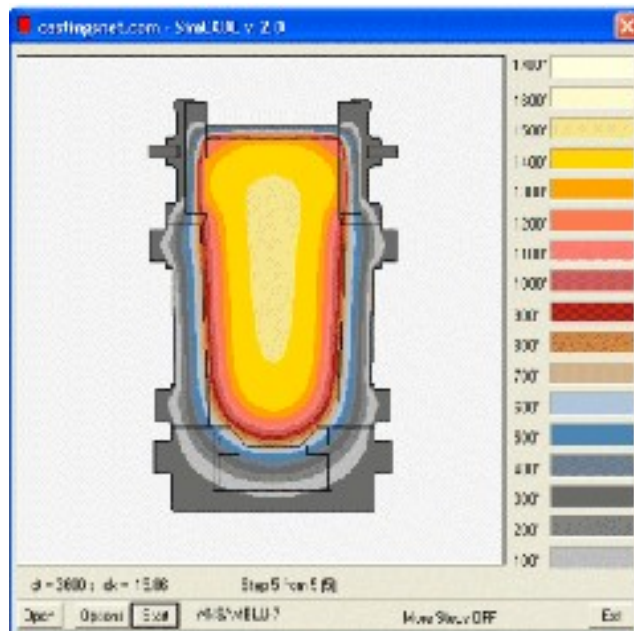


# ANALYSIS REPORT

## Industrial Soft

### MATERIAL AND MECHANICAL PROPERTIES HETEROGENEITY OF AMS 6414 STEEL FORGING PRODUCTS

Chemical Composition, Casting Technology and 50T Ingot Mold Design Analysis



# Table of Contents

## Introduction

### 1 Influence of Casting Technology on Macro-Segregation in AMS 6414 Forgings Products

- 1.1 Influence of pouring temperature
- 1.2 Influence of hot top size
- 1.3 Influence of mold temperature
- 1.4 Conclusions and recommendation

### 2 Influence of Chemical Composition on Macro-Segregation in AMS 6414 Forging Products

- 2.1 Influence of C content
- 2.2 Influence of Si content
- 2.3 Influence of Mn content
- 2.4 Influence of P content
- 2.5 Influence of S content
- 2.6 Influence of Ni content
- 2.7 Influence of Cr content
- 2.8 Influence of Mo content
- 2.9 Conclusions and recommendation

### 3 Ingot Size and Mold Design Influence on Macro-Segregation in AMS 6414 Forging Products

- 3.1 Influence of ingot height/diameter ratio
- 3.2 Influence of ingot taper
- 3.3 Influence of mold wall thickness
- 3.4 Conclusions and recommendation

### 4 Ingot Mold Assembly Taken in Analysis

### 5 Analysis Operations Cost

- 5.1 Thermal and Geometry Data
- 5.2 Casting Technology Analysis
- 5.3 Chemical Composition Analysis
- 5.4 Ingot Geometry and Mold Design Analysis
- 5.4 Operation Tasks Duration
- 5.5 Rates

## Introduction

The analysis made by Industrial Soft, Montreal, Canada helps you to predict if a steel forging product will contain material and mechanical properties heterogeneity due to A-segregation. It allows you to predict both, the macro-segregation detected by ultrasonic inspection and material heterogeneity for a particular steel grade and ingot used to manufacture the forging part.

If you have the manufacturing records of the ingot, this service will give you tools for estimating quality of the forging parts. The report we deliver will tell you if the semi-manufactured or forging product you want to acquire is free of segregations and has chemical composition and mechanical properties homogeneous.

The service we offer, based on the method proposed by K.Suzuki and T.Miyamoto, **Japan Steel Works Ltd** and developed by Industrial Soft, embeds over eight years experience in ingot solidification process analysis and over ten years in mold assembly design. The software has been tested and verified in industrial conditions with **Doosan IMGB**, Romania and **Companhia Siderúrgica Paulista – COSIPA**, Sao Paulo, Brazil.

The report about your forging part will come with practical recommendations and help you to improve the homogeneity of the material, take better decisions, save time and money by:

- requesting forgings made using ingots with size and shape that guarantee the homogeneous mechanical properties;
- avoiding forgings made from ingots with hidden macro-segregation, defects not detected even by ultrasonic inspection;
- asking for a product with optimized ferroalloys consumption;
- taking better decisions concerning derogation requests about chemical composition and other technological factors that influences homogeneity of forgings.

The analysis is available for all ingot sizes and the following ASTM steel grades and their equivalents:

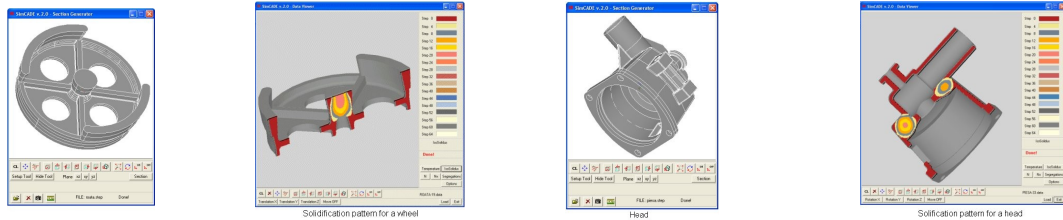
A1021, A 108, A 125, A 255, A 266, A 275, A 288, A 289, A 29 , A 290, A 291, A 295, A 304, A 311, A 321, A 322, A 336, A 355, A 372, A 388, A 391, A 400, A 413, A 418, A 427, A 434, A 456, A 466, A 467, A 469, A 470, A 471, A 472, A 485, A 499, A 503, A 504, A 508, A 521, A 531, A 534, A 541, A 551, A 561, A 575, A 576, A 579, A 592, A 597, A 600, A 604, A 646, A 649, A 663, A 668, A 675, A 681, A 686, A 689, A 696, A 700, A 702, A 711, A 723, A 729, A 730, A 739, A 745, A 756, A 765, A 768, A 788, A 833, A 837, A 859, A 866, A 891, A 892, A 906, A 909, A 914, A 920, A 921, A 939, A 940, A 952, A 956, A 965, A 966, A 973, A 982, A 983, A 986, E 588, E 618

If you need the analysis made for a particular ingot size or steel, for a price quote, please contact Ovidiu Bogdan by email at [bogdan@castingsnet.com](mailto:bogdan@castingsnet.com) or by phone at 514-3425833.

Industrial Soft is a cost effective engineering and software development company **specialized in metal industry applications**. We are located in **Montreal, Canada** but we can serve you wherever you are in the world. We provide the following products and services:

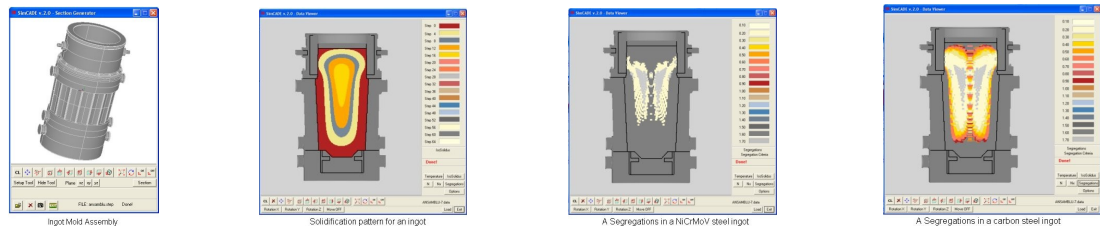
**1. Castings solidification simulation service. Porosity prediction**

Numerical simulation of the solidification process enables you to evaluate the casting design technology before committing to expensive pattern or die manufacture. We use Niyama criteria to predict porosity in aluminum and steel castings.



**2. Ingot solidification simulation service. A-segregation prediction**

This service allows you to check if the ingot size, shape and chemical composition of steel poured are appropriate to minimize A-segregations detected by ultrasonic test and increase the homogeneity of mechanical properties.



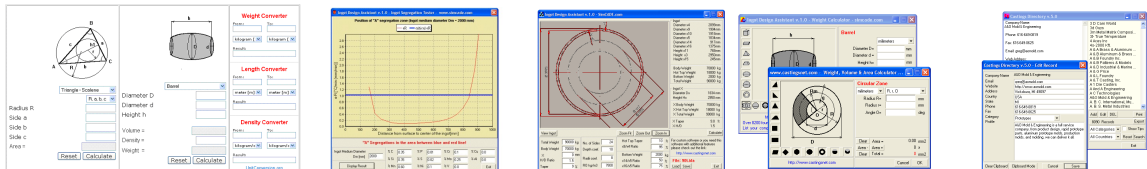
**3. Mold assembly projects for big and small ingots**

This service provides a complete mold assembly project for pouring ingots up to 350 tons. Also, we offer projects for hollow ingots or 2, 4 or 8 bottom poured ingots. The size and shape of the ingots will be chosen according to the steel type poured and the forging size in order to minimize A-segregations type defects. Contact us if you need more info about this service.



**4. Custom software for design, engineering, scientific, database and online applications**

Our software comes with simple and easy installation programs, intuitive graphical user interface, and informative help files with instruction manuals.



**5. Upgrade or customize your existing software**

We have expertise in re-writing, modifying and debugging software code for design, engineering, scientific, databases and online applications using following languages:

- engineering and scientific applications (Visual C++, Visual Basic, Pascal);
- databases applications (MySQL, sqlite3, Visual Fox, DBase, Access);
- online applications (PHP, HTML, JavaScript, Ajax, Flex).

**6. Online advertising on castingsnet.com and website design - <http://castingsnet.com/premium.htm>**



**castingsnet.com**, online since 1999, is the biggest online directory and search engine that lists foundries, foundry equipment and foundry supplies. If you already own a website, we offer cost effective advertising on our online directory; if not, we can build a website that will inform people about your products and services and serve as a 24/7 advertisement for your company. To increase the visibility of your company, we list your website on castingsnet.com for free of charge.

**7. Castings Directory v.5.0 – CD-ROM – <http://castingsnet.com/cdrom.htm>**



Castings Directory 5.0 is the CD-ROM version of our online search engine for foundries and related companies – **castingsnet.com** Very simple and easy to use, even by people with only basic computer skills, the software provides virtually instant access to over 8.200 worldwide foundries, foundry equipment and foundry supplies.