

## Online Tracking for Single Unit in Investment Casting of Jet Engine Critical Components

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The paper shows the concept and implementation of a dedicated, computer module of production unit tracking – wax patterns and assemblies, moulds and single casts in production line, which data are collected automatically supplemented by the information entered manually by the operator. Currently there is no production unit’s position tracking in the individual processes. The essence of this module is full control of the production unit location in each stages. It is assumed that by monitoring the location of the unit in each device can be identified by extraordinary variability arising from the state of individual devices in all stages. The module allows specifying the location of individual parts in casting system. Innovative dedicated software was developed, that allows to determinate the defects and generates detailed statistical analysis based on multiple filters.

**Keywords:** *superalloys, investment casting, expert system, tracking*

### 1. Introduction

Manufacturing processes of the jet engine critical components using lost-wax investment casting are classic examples of the so-called special processes. Due to the complexity of each single processes and their collection, strong emphasis is put on their computer-aided realization.

Diagram of the manufacturing process, under the tracking system shown in Fig. 1.

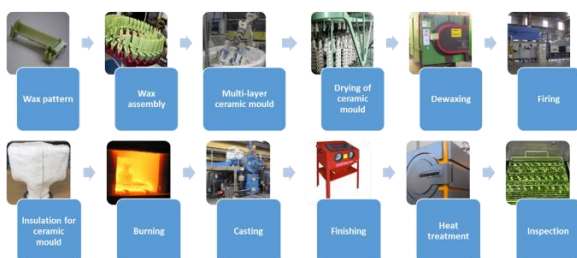


Fig. 1 Investment casting process scheme

### 2. Concept of expert system

#### 2.1 Production unit “Online tracking” module

Presented functionalities are part of the computer expert system to ensure comprehensive supervision for all technological and organizational processes.

The essence of this module is full control of the production unit location in injection molding machines, producer, autoclaves for dewaxing, furnace for moulds firing, burning, pouring and cores leaching autoclaves. It is assumed that by monitoring the location of the unit in each device can be identified by extraordinary variability arising from the state of individual devices in the stages: wax patterns and wax assemblies making, moulds making and drying, dewaxing, moulds firing and burning, casting, ceramic cores leaching and inspection.

The figure below shows the main window tracking system.

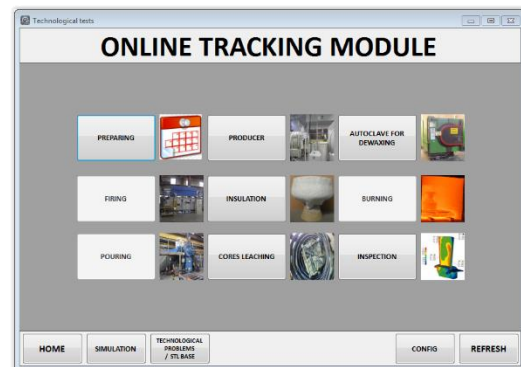


Fig. 2 “Online tracking module” main window

The screen gives the possibility move to the specific stage of the production process and viewing information that is collected automatically and entered by operators. For each of the individual steps may be accompanied by documentation (audio, video, \*.txt files). The location of each patterns in a single mould and device, is tracked by sample.

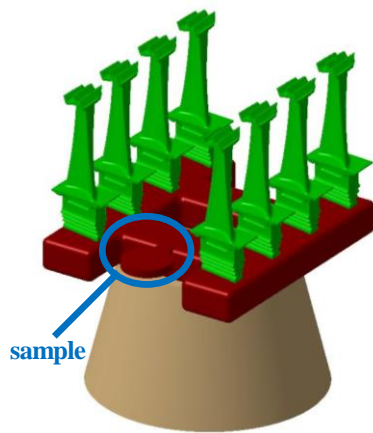


Fig. 3 Wax assembly with sample

Selected and presented examples of screens for the unit operations – coating and drying moulds in producer and ceramic cores leaching in an autoclave.

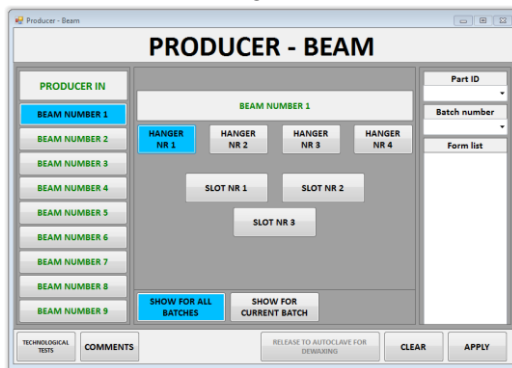


Fig. 4 “Producer” window

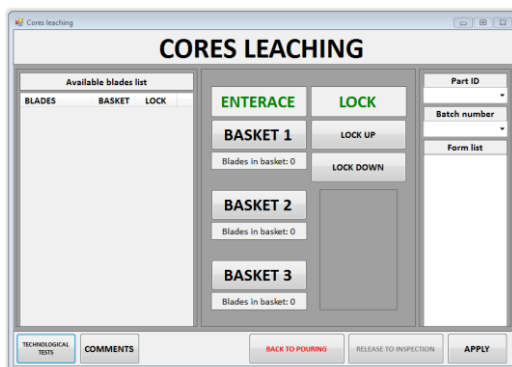


Fig. 5 “Cores leaching” window

Screen presented on Fig. 4, it is possible to mark the information on the location of the mould on the beam, hanger and place. The module collects data about the coating process parameters, humidity, temperature and drying time.

Another exemplary screen (Fig. 5) shows the tracking of a single blade in an autoclave for leaching the cores. The screen allows the operator to identify the location of individual components in one of three baskets

along with the record information on the direction of their arrangement. The module collects information about the leaching, including the composition and temperature of the electrolyte, pressure in the autoclave and leaching time.

## 2.2 “Interactive map of defects” module

The module allows specifying the location of individual parts in casting system, and then mark certain defects on models parts (divided into stages of quality control). Innovative dedicated software was developed, that allows to determinate the defects and generates detailed reports and statistical analysis based on multiple filters, areas of casts, type of alloy, type of casting furnace and other.

The areas are defined in the \*.stl file using a recording color information for each the single triangles. On loaded model into module applied can be selected identified defects in inspection stages. The database and thereby to the module analysis are recorded location coordinates and information about the defect. An example screen presented in Fig. 6.

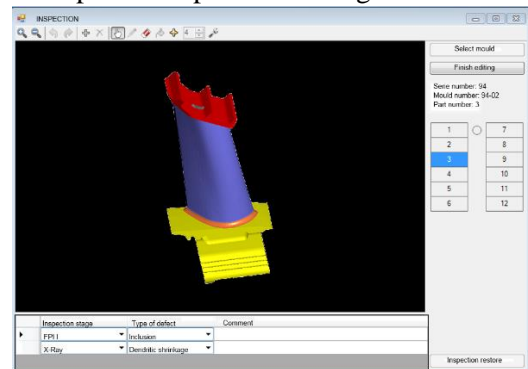


Fig. 6 “Interactive maps of defects”

## 3. Conclusions

Presented concept has unique character, it is possible to implement in different casting processes.

## Acknowledgements

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## References

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