MetaCause Process Optimizer

Case Study 3 - Sand Casting

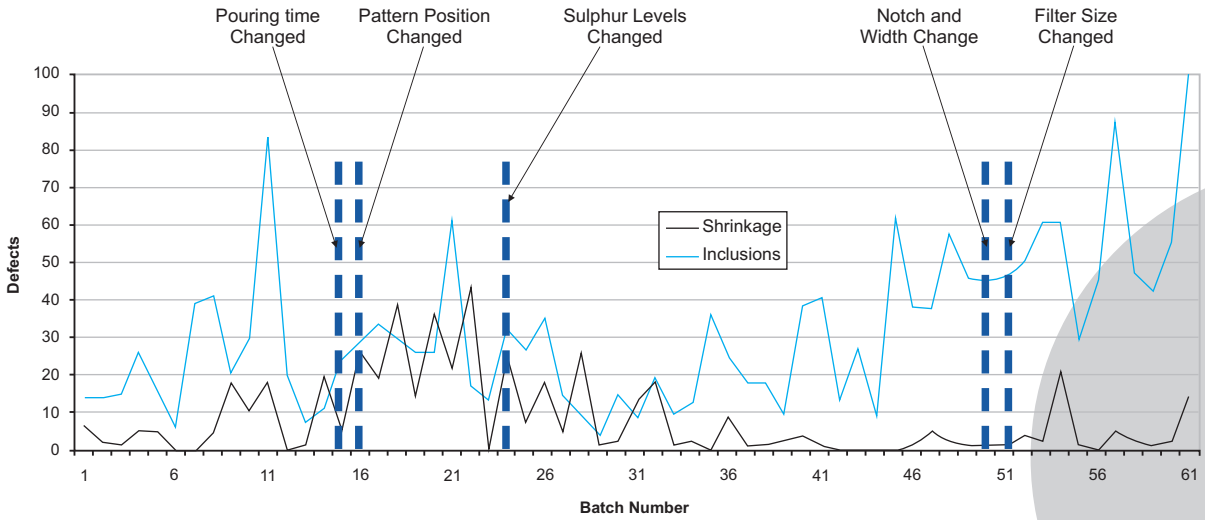
This example shows the effective use of the MetaCause Process Optimizer in a precision sand casting foundry with a high pressure moulding facility.

The Problem:

A sand casting foundry found that the number of castings rejected due to shrinkage and sand inclusions defects had increased to an unacceptable level.
The process experts have identified nine parameters in the process which may have an effect, but they have also logged design/process changes they have made during the last month. The parameters recorded are shown in the table below:

Process Parameters		Design/Process Changes
Production	Compactability	Pouring Time
Active clay	Return Sand Moisture	Change Pattern Position
GCS	Prepared Sand Temp	% Sulphur in Bath
Loss of Ignition	LM Wt per Box	Notch Area and Width
		Filter Size

The design/process changes are recorded on a timeline plot of the number of defects per production batch as shown in the plot below:



The Solution:

Changes such as design changes, machine maintenance, or process changes logged during a production run can be easily analysed along with other recorded parameters. MetaCause analysis will highlight which process settings give the best chance making the perfect part, and which changes to the process have the greatest and most positive effect. It uses its pattern recognition algorithm to analyse data about good and bad castings to discover Factor-Response relationships the way human mind understands and learns.

Results:

Response: Sand Inclusion

Optimal Process Settings

Factor	Setting	Importance Weighting
Filter Size	Low	67.6%
Notch Area and Width	Low	67.6%
Prepared Sand Temp	Low	48.0%
Compactability	High	46.0%
LM Wt per Box	Low	45.7%
Loss of Ignition	Low	43.4%

Process Settings to Avoid

Factor	Setting	Importance Weighting
Prepared Sand Temp	High	50.7%
Change Pattern Position	High	50.5%
Pouring Time	High	48.9%
LM Wt per Box	High	43.6%

Response: Shrinkage

Optimal Process Settings

Factor	Setting	Importance Weighting
% Sulphur in Bath	High	60.0%
GCS	Low	54.3%
Prepared Sand Temp	Low	53.1%

Process Settings to Avoid

Factor	Setting	Importance Weighting
% Sulphur in Bath	Low	60.8%
Prepared Sand Temp	High	51.7%
GCS	High	49.7%
Pouring Time	Low	47.9%

For the process/design change parameters, 'Low' refers to before the change and 'High' describes the process after the change.

Conclusions:

The MetaCause report has highlighted the effect of three major process changes:
'% Sulphur in Bath', 'Filter Size' and 'Notch Area and Width'.
MetaCause discovered evidence in the production data to show that

- After the Percentage of Sulphur in the bath was changed (High), the number of shrinkage defects produced was reduced.
- Also, Filter Size and Notch Area and Width were optimal before the change (Low Settings).

MetaCause analysis also suggested maintaining Compactibility between its actual process mean and upper control limit values and kepping Prepared Sand Temperature within its actual process mean and lower control limit values.

Using the above analysis the foundry was able to quickly identify complex relationships and reduce the number of defects being created.

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