

# Wax Testing.. Now and the Future

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Exposition

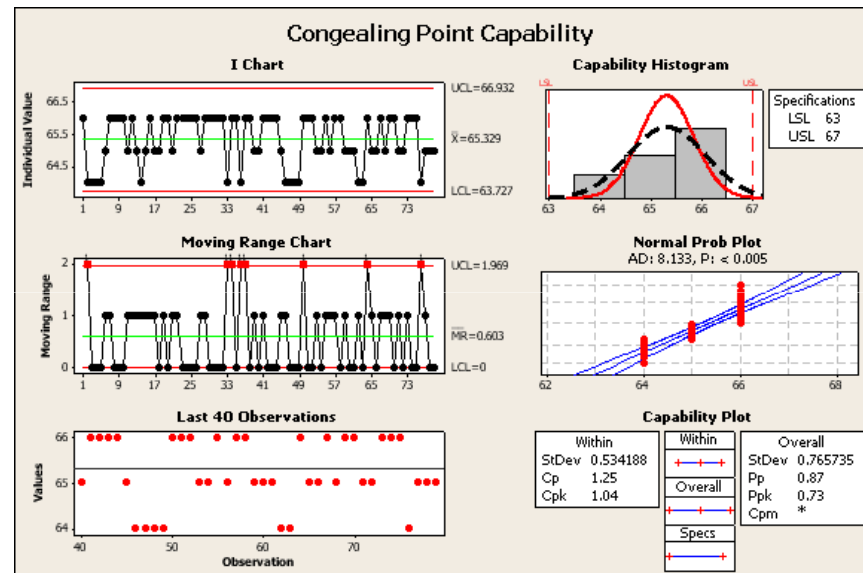
Krakow, Poland

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**Blayson**

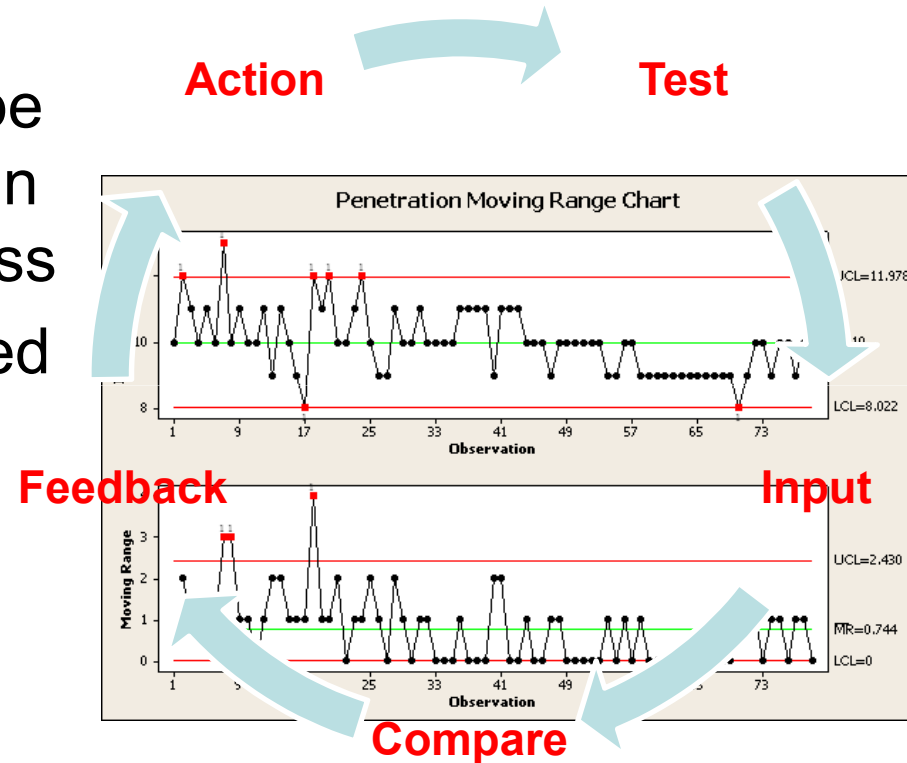
# Current Testing

- Current Wax testing is designed to achieve one primary aim
- To ensure that a wax meets an agreed specification so customers receive a consistent product



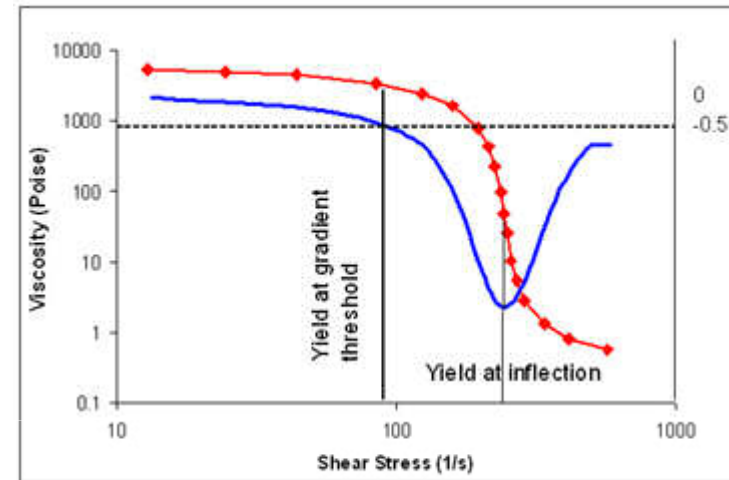
# Test Data

- Test data generated can be used to monitor trends within both the wax and the process
- Blayson uses an automated link between the input database and Minitab SPC software to monitor trends and issue action warnings



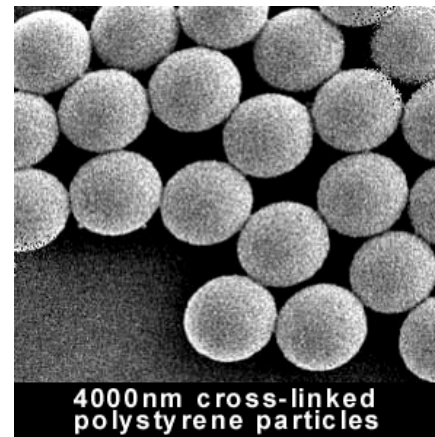
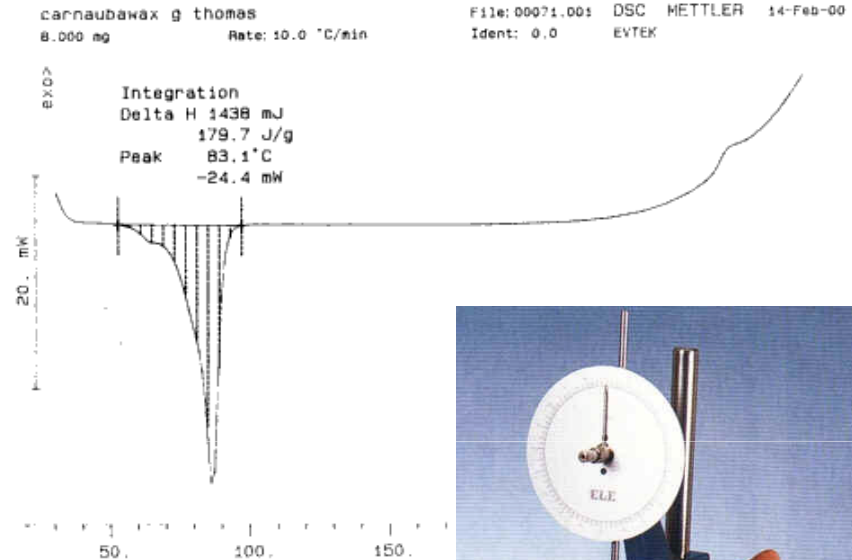
# Current Tests

- Current tests used are almost without exception taken from other industries and adapted for use in wax manufacture
- The type of tests carried out and the nature of the test can vary from supplier to supplier



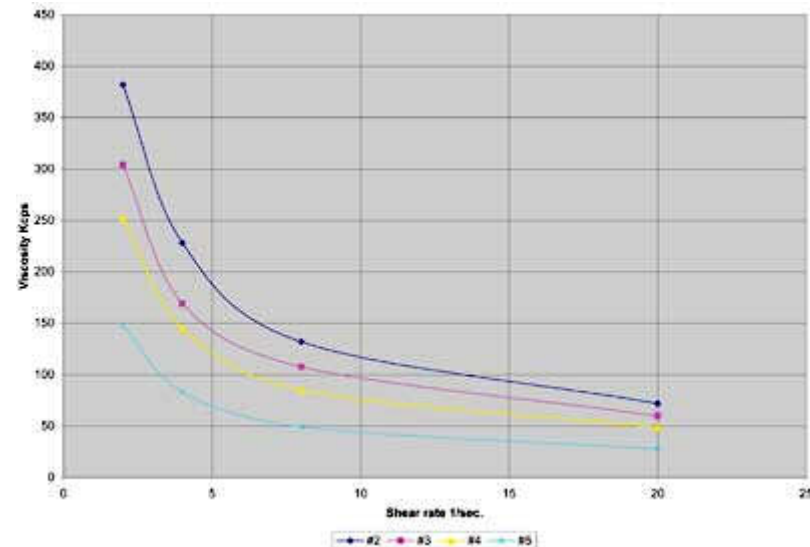
# Current Tests

- Congealing Point, the temperature at which the wax changes from liquid to semi liquid indicates the optimum injection temperature
- Melting Point is useful for dewax purposes
- Penetration Test indicates the surface hardness of a wax
- Filler measurement shows the percentage of filler



# Current Tests

- Ash test measures the percentage of non carbonaceous materials in a wax
- Viscosity measurement estimates the fluid properties of a wax across a range of temperatures and can be shown at a fixed temperature



# Alternative Thinking

- Although current test regimes give useful information it is not directly related to wax usage
- The introduction of three alternative tests would enable foundries to be supplied with process related information
  - Enabling any necessary process related adjustments to be made
  - Leading to improved injection consistency and efficiencies



# Future Testing

1. Elemental ash analysis will say what elements are contained within the non carbonaceous materials in a wax
2. Fluidity measurement carried out at injection temperature and pressure will accurately indicate how a wax performs during injection

Periodic Table of Elements

1	2																	10
3	4																	10
11	12																	18
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
87	88	89	104	105	106	107	108	109	110									

\* Lanthanide Series  
 + Actinide Series

Legend - click to find out more...

<span style="color: green;">■</span> H - gas	<span style="color: blue;">■</span> Li - solid	<span style="color: red;">■</span> Br - liquid	<span style="color: yellow;">■</span> Tc - synthetic
<span style="color: lightgreen;">■</span> Non-Metals	<span style="color: cyan;">■</span> Transition Metals	<span style="color: lightblue;">■</span> Rare Earth Metals	<span style="color: orange;">■</span> Halogens
<span style="color: yellow;">■</span> Alkali Metals	<span style="color: lightcyan;">■</span> Alkali Earth Metals	<span style="color: purple;">■</span> Other Metals	<span style="color: lightorange;">■</span> Inert Elements

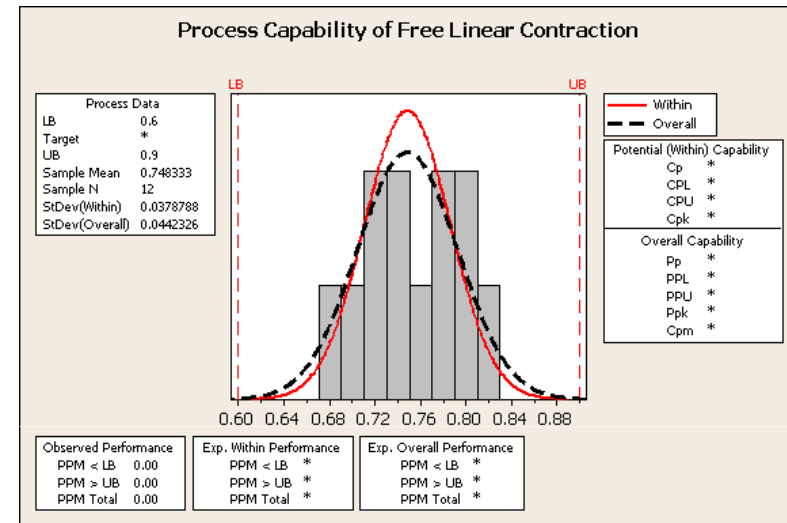




# Future Testing

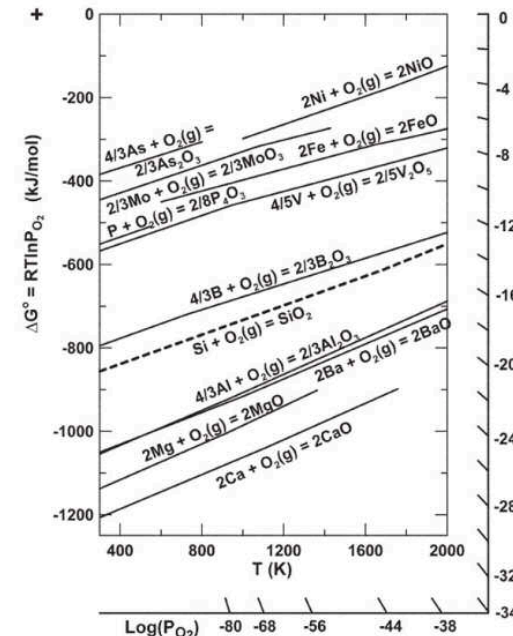
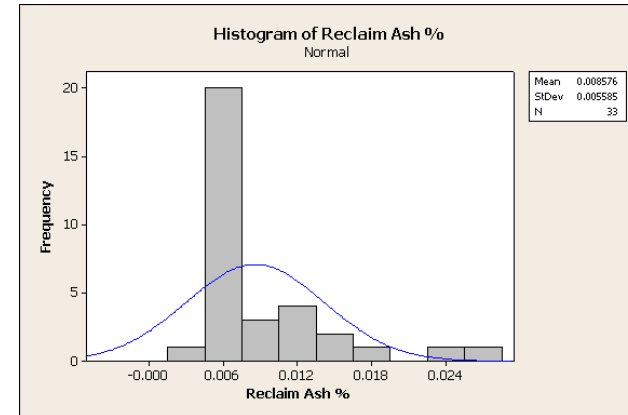
3. Free linear contraction can provide information on a batch to batch basis

- increasingly required, particularly for cored parts
- These three sets of results will ensure foundries are given the information they need to maximise their process accuracy and repeatability whilst minimising process costs



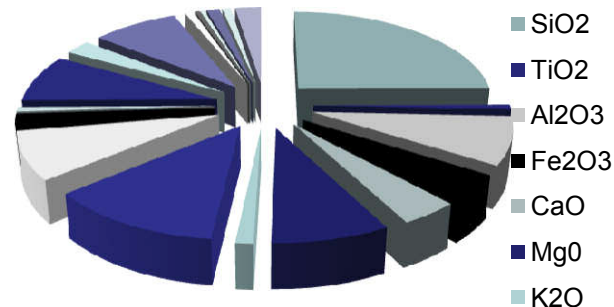
# Elemental Analysis

- Wax recycling technology has advanced to levels where very low levels of ash are achievable
- The argument for the use of virgin wax for gating (runners) is that it is not known what elements may be present within recycled wax
- Knowledge of elements present and their percentage should give foundries sufficient confidence to use recycled wax

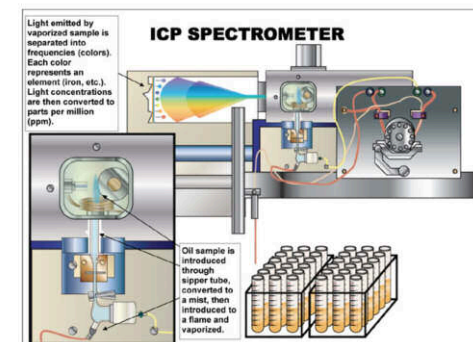


# Elemental Analysis Test

- To date for elemental analysis of wax residue, 10 kg of wax must be burned to generate sufficient ash
- In conjunction with a British research company Blayson has developed a unique test using ICP Spectrometry which can test the wax itself
- The ICP (Inductively Coupled Plasma mass spectrometry) test is an “Aircraft Industry Standard”
  - gives results to 3 decimal places
- This breakthrough allows foundries to target particular elements of concern and set target limits for them

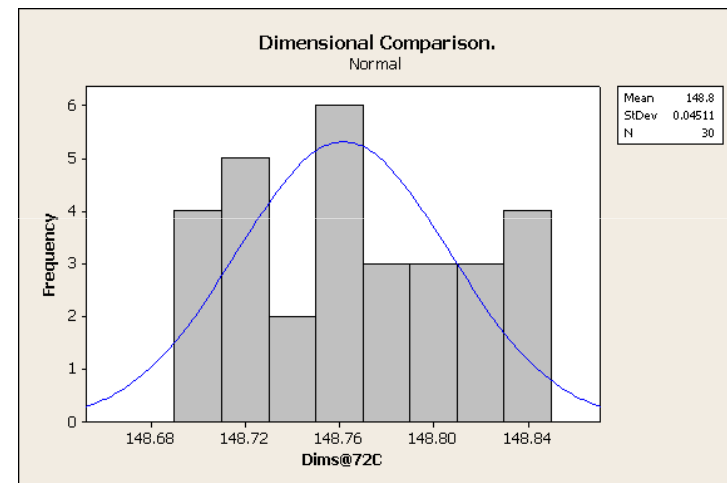


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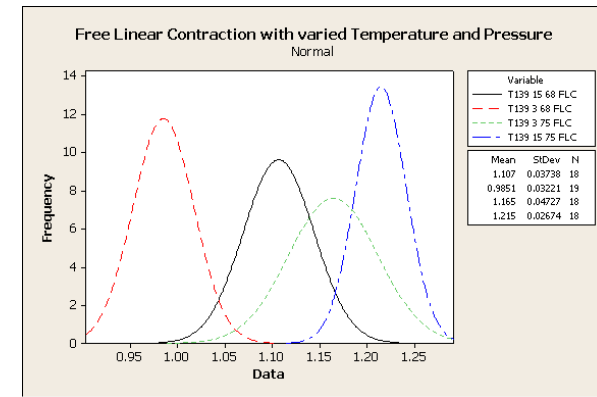
# Dimensional Analysis

- Dimensional stability is a major advantage of investment casting
- It is a contradiction therefore that the capability of a particular wax is not quoted on a batch to batch basis
- To achieve this requires injection on a reliable injection press



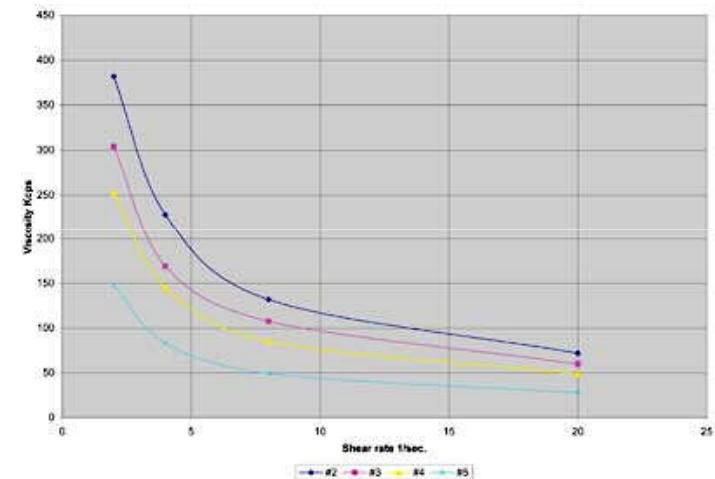
# Dimensional Analysis Test

- To develop this test other issues had to be overcome
- Variation of Dimensions with :
  - Temperature
  - Pressure
  - Test piece size
- It was also necessary to monitor pressure within the die to ensure a correct injection cycle
- The test Blayson has developed now allows us to monitor the Free Linear Contraction on a batch to batch basis



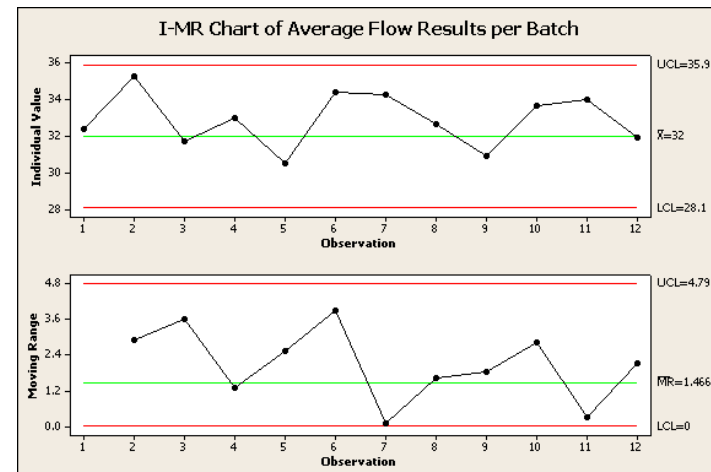
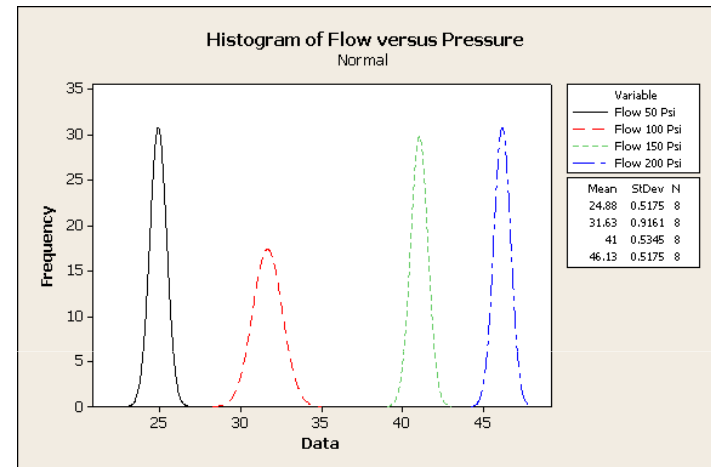
# Fluidity Analysis

- There is a distinct difference between Viscosity and Fluidity
- Viscosity results do not necessarily give the foundries the information they need
- The introduction of a test that monitors fluidity at injection would solve this and provide the relevant data



# Fluidity Analysis Test

- Controls on key parameters:
  - Temperature of wax and die
  - Pressure and flow
  - Injection time
  - Release agent
- As with Dimensional analysis Blayson is now able to give real injection flow characteristics on a batch by batch basis



# Summary

- Introduction of a new wax testing regime will facilitate a step forward in wax process control
- Will provide accurate batch to batch information
- Enabling foundries to make any necessary process adjustments
- Ensuring consistency in the wax injection process
- Reducing process costs



“RIGHT FIRST TIME”

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