

Cost Reduction Through Wax Reclamation

Agenda

- Wax Reclamation
 - Reclamation options
 - ‘Reclaim’
 - ‘Reconstituted’
 - Processing route
 - Controls
 - Performance
 - Uses
- Cost benefits

Wax Reclamation

- Has existed for a long time often with simple reclamation carried out on-site
 - dewatering, sometimes basic filtration
- In most markets reclamation has largely moved to specialist wax companies
 - with specialised recycling equipment
 - who have local authority approval for movement and processing of recyclable material
- Reclamation has obvious environmental and economic benefits
- The development of advanced recycling techniques has allowed the wider usage of recycled wax

Wax Reclamation - Processing

- Two routes are available for the reclamation of used (ex autoclave) wax
 1. Simple recycling techniques allow reclamation for use as runner wax – **‘Reclaim’**
 2. Advanced recycling techniques allow reclamation for use as pattern wax – **‘Reconstituted’**
- Both allow investment casting foundries to make significant savings to their wax costs without detriment to casting quality

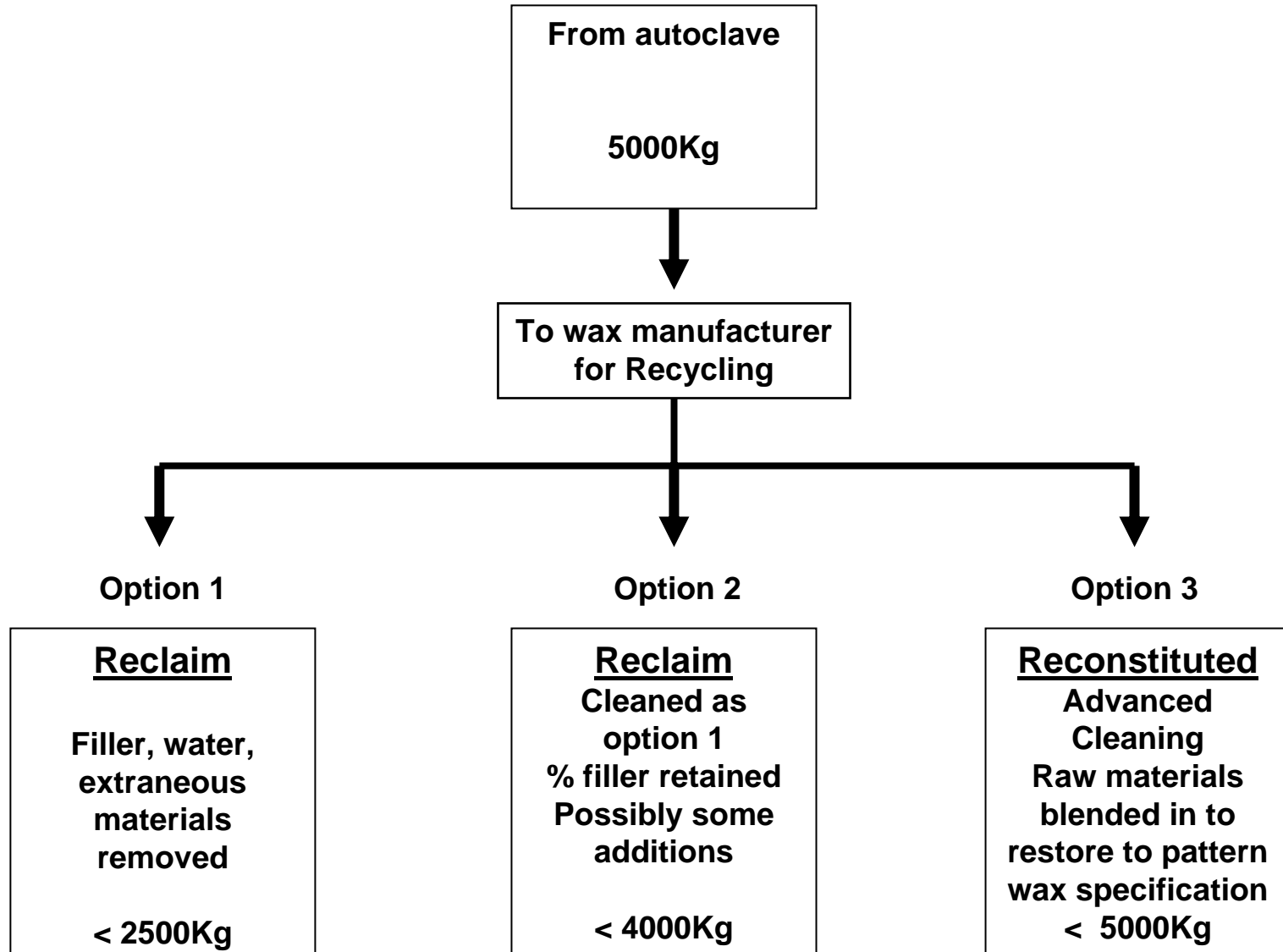
Reclaim Wax

- Used almost exclusively for runner production
- Products can range from simple 'reclaim' wax, or with additions to meet an agreed specification
- Used wax is cleaned and filtered
- Blayson usually recommends retaining filler material in the final product. This gives the following advantages to the runner wax :
 - improved injection performance
 - quicker setting
 - a more stable wax with less distortion
 - reduced cavitation/sinkage

Reconstituted Wax

- Customers returned wax is marked, kept separate and Reconstituted for their use only
- Using advanced reclamation techniques used wax is cleaned and filtered
- Virgin materials are then added to adjust properties and 'Reconstitute' the wax to within the parameters of the original specification
- The results of reconstitution are very good with properties in line with those of the virgin material
- A complete range of wax patterns can be produced with reconstituted wax
- Significant cost savings are achievable, with no loss of performance or quality

Wax Reclamation Processing Route - Major Options



Recycled Wax Usage - Runners

- Reclaim runner wax is used by the majority of foundries across all market sectors
- The use of a good quality reclaimed runner wax can significantly contribute to lower process costs
 - less scrap
 - greater throughput
 - improved runners = improved casting quality

Recycled Wax Usage - Patterns

- Over recent years many foundries in the cost driven 'Commercial' sector have switched to the use of reconstituted pattern wax either:
 - reconstituted 100%
 - or containing a percentage of reconstituted material

'Aerospace' Sector

- The aerospace sector has so far resisted reconstituted pattern wax
- Due to the relative disparity between wax costs and value of castings produced.
 - the need for costly re-approvals is also a significant factor
 - as are concerns regarding possible trace elements
 - however reclaim wax is widely used for runners
- Technically we believe that Reconstituted wax, produced through a 'closed loop' system, could be used for pattern production without detriment to casting quality

Quality Comparison : Reconstituted v Virgin Wax

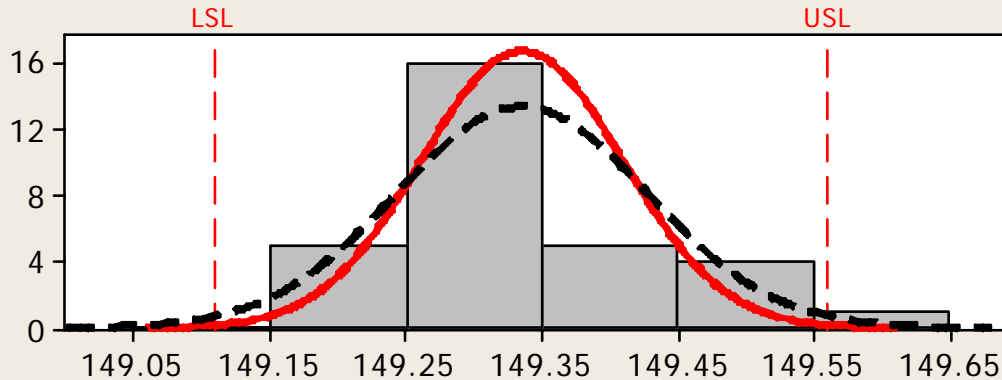
- No detriment to chemistry with Reconstituted wax
 - No significant (measurable) increase in key elements
 - No significant increase in Ash content
- Dimensions – SPC indicates a close match between the dimensional capabilities of Reconstituted and Virgin wax

Dimensional Capability

Capability Histograms of Test Block Virgin and Reconstituted A7-FR/60

Virgin Wax

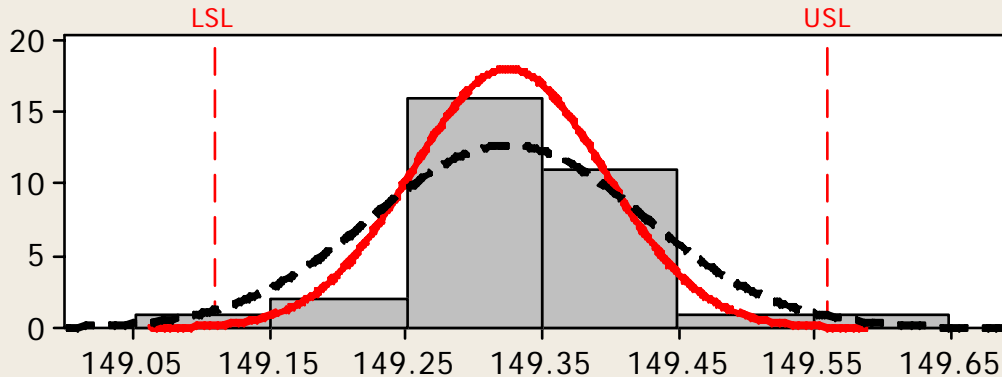
Within	
Cp	1.011
CPL	1.012
CPU	1.010
Cpk	1.010



Overall	
Pp	0.808
PPL	0.808
PPU	0.807
Ppk	0.807
Cpm	*

Reconstituted Wax

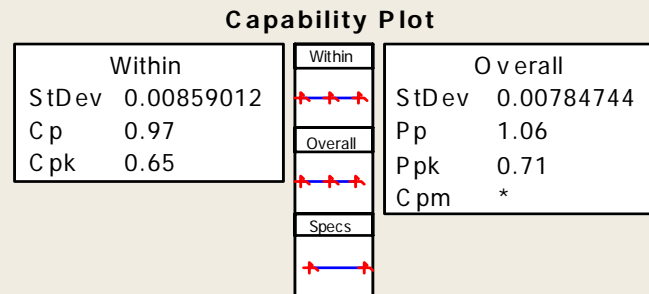
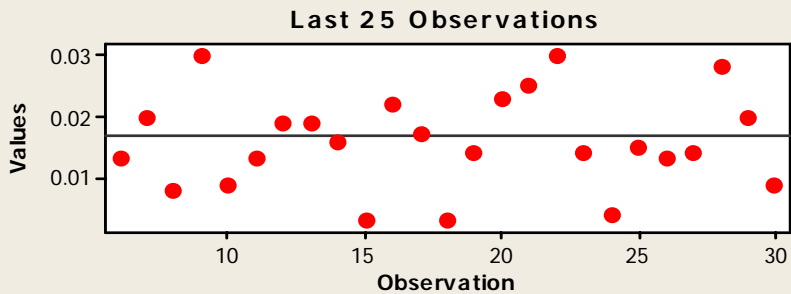
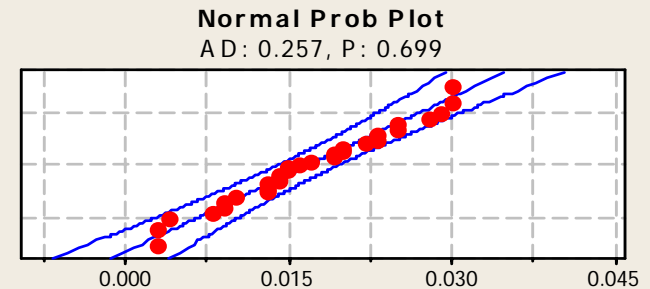
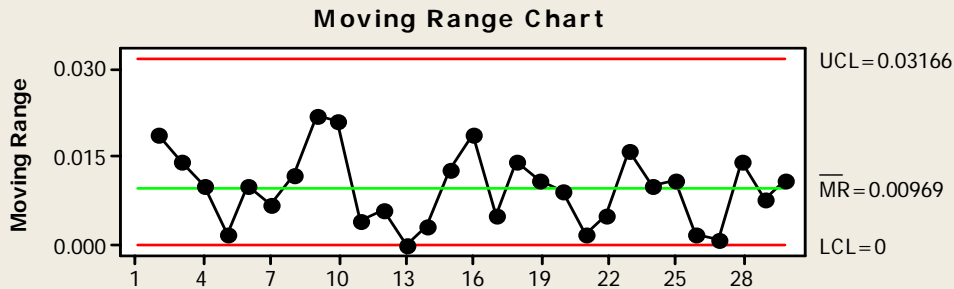
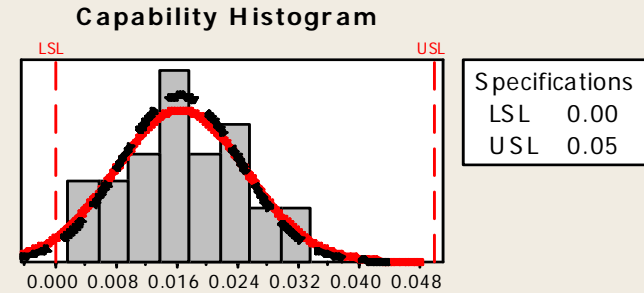
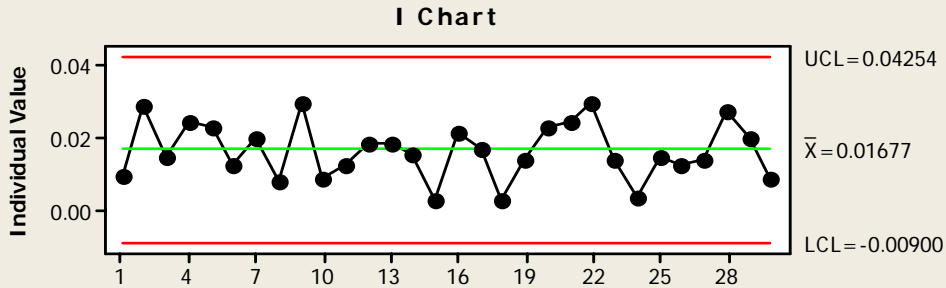
Within	
Cp	1.057
CPL	1.011
CPU	1.104
Cpk	1.011



Overall	
Pp	0.746
PPL	0.713
PPU	0.779
Ppk	0.713
Cpm	*

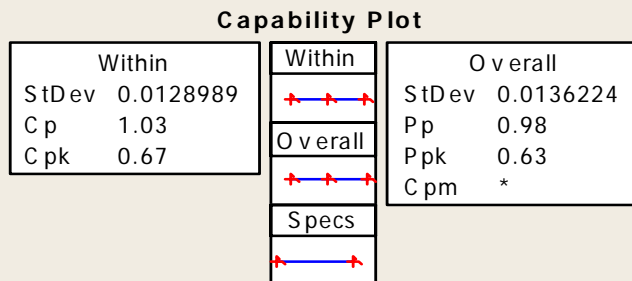
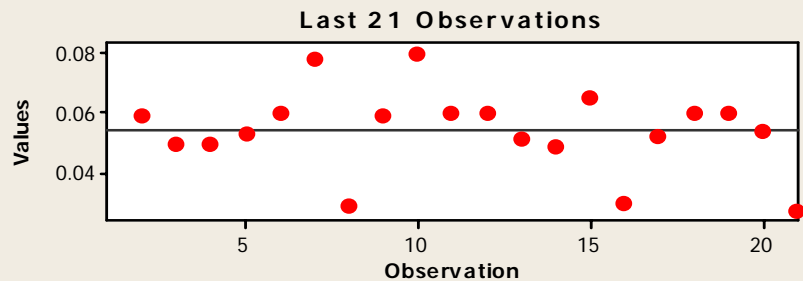
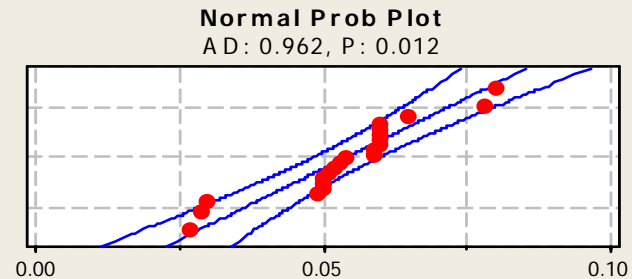
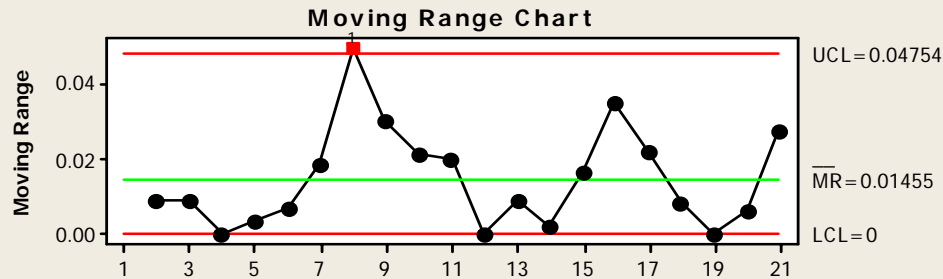
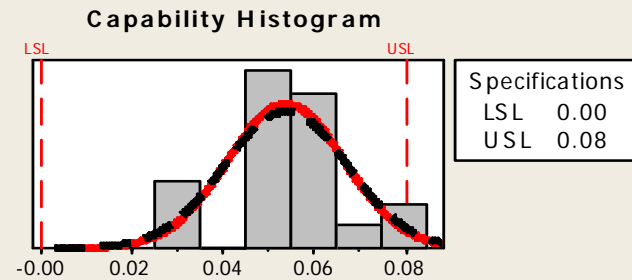
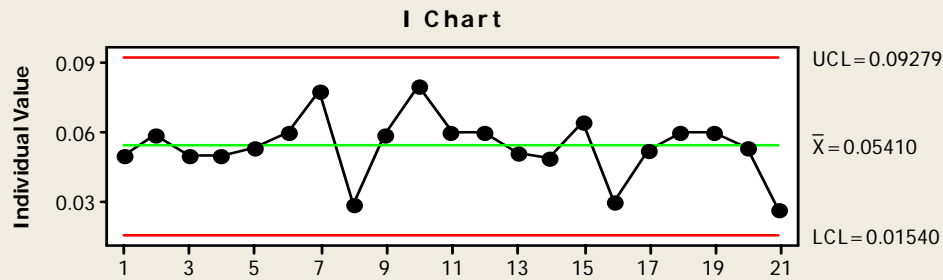
Ash Content - Virgin Wax

Process Capability Sixpack of Virgin Wax Ash content

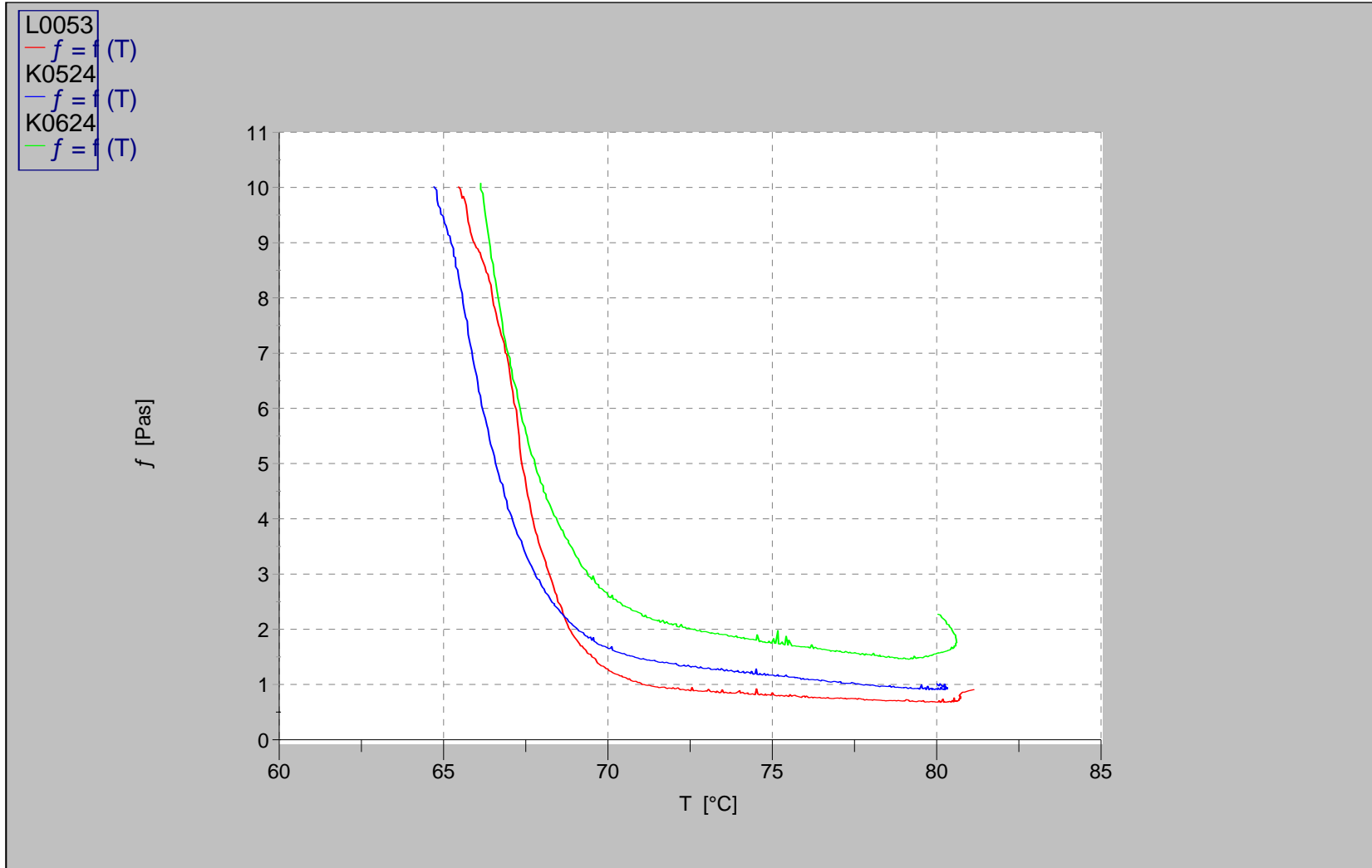


Ash Content – Reconstituted Wax

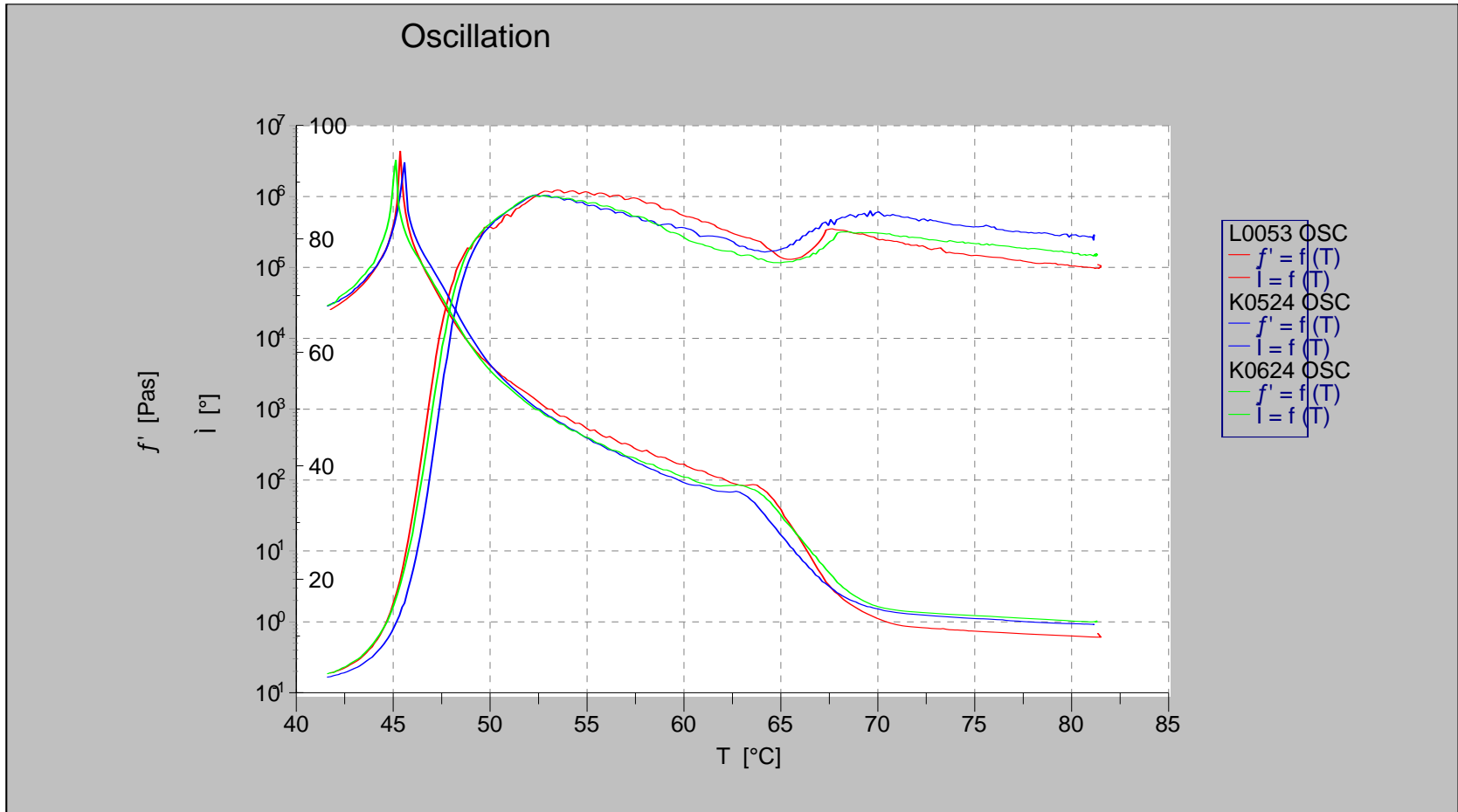
Process Capability Sixpack of Reconstituted Wax Ash content



Viscosity Comparison



Rheology Comparison



Critical points for Reconstitution

- Foundries must use a wax that contains suitable materials for reconstitution
- Imperative to start with a virgin wax that will resist oxidation
- The use of a non-sticky virgin wax will help reduce the use of silicone release agent
 - less chance of ash levels increasing from silicone entering the system
- Ideally only one base wax should be used in the foundry's wax system
 - easier to monitor and control
- Prudent to occasionally replenish system with some virgin wax addition

Quality Control

- It is extremely important that the wax manufacturer maintains total quality control over the process
- The incoming material from a foundry is :
 - marked and kept separately so customers receive back their own material (to ensure exclusion of undesirable constituents)
 - tested for :
 - Ash content
 - Melting and Congealing point
 - Viscosity
 - Filler content
 - Water content
- From these results, dependent on the requirement, additions are made in order to reclaim or reconstitute the wax to within agreed limits

Controls on Wax for Reclamation

- Used wax must be clean, i.e. without foundry floor waste, boots, gloves, bottles, cans, broken shell etc
- The amount of silicone used in the process should be minimised
- Water mixed with the wax during dewax should be minimised
- A filter cloth placed over the autoclave tray can help prevent ceramic sand entering the wax during dewax
- Autoclaved wax should be made into blocks on pallets and suitable for transportation
 - blocks should be strapped and wrapped to further reduce the chance of contamination during transportation/storage
 - ‘big bags’ offer a cost effective option

Wax Reclamation - Cost Benefits

- The use of reclaim and reconstituted wax offers significant cost savings to investment casting foundries
- Using a fully reconstituted pattern wax can generate savings of approximately 20%
- Wax disposal costs are avoided
 - becoming even more expensive
 - not always available/possible
- The discipline of good process control will itself be a major benefit and reduce costs

Summary

- Wax reclamation is not new and recycling has always taken place
- The latest techniques allow full reconstitution to virgin wax specification
- This can generate savings of up to 20%
 - on top of saving disposal costs