

Indestructible Paint

Escaping the Traditional Bucket and Stick

Indestructible Product Range

- 1. 2 Part Epoxy Primer and Topcoat**
- 2. 2 Pack Polyurethane Primer and Topcoat**
- 3. Dry Film Lubricants**
- 4. Intumescent Coatings**
- 5. Heat Control Coatings**
- 6. Defence Coatings**
- 7. Single Pack Air drying Primers and Topcoats**
- 8. Inorganic coatings for heat resistance, corrosion protection, dry film lubrication, turbine coating, etc**

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Manipulating the Technology

- Today the coatings in categories 1-7 are based on solvent containing technology.
- This technology has a long and successful history.
- The manufacturing methods for Organic coatings carried in solvent are well known and in most cases very forgiving.
- Tomorrows products may be Water Carried Organics and for Indestructible Paint an increased number of Inorganic Formulations





**During the
manufacture of
Inorganic coatings,
Indestructible
Paint learned that
the add the
ingredients to a
pot and mix
principle has
limitations.**

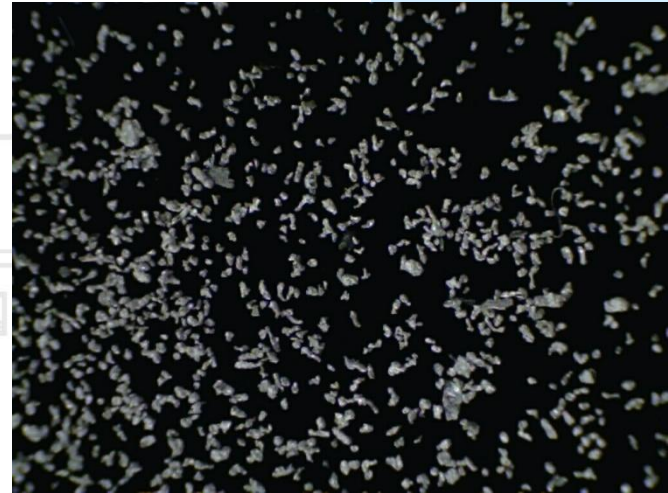
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The Problem – powder turned to grains in a smooth coating



6 micron d_{50} Al
powder, x200
magnification



Al grains removed
from faulty
manufacture, x200
magnification



Why?

We Always Do It This Way

- **Production Staff**
 - ❖ We always follow the instructions
 - ❖ We always use the same mixer
 - ❖ The Batch size never varies
- **Laboratory**
 - Production must have changed the process
 - The Raw Materials must be at fault
 - It works when we do it in the Lab



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Breaking Down The Barriers

- Assume that the six previous statements are valid
 - ❑ How would the Manufacturing staff change the process
 - ❑ How many operators know how to make the product
 - ❑ What do the Manufacturing staff not like about the process
- ❖ How would the Technical staff change the process
- ❖ Did the Technical staff make assumptions when writing the process instructions
- ❖ Where do the Technical staff think the Manufacturing personnel cause errors in the process

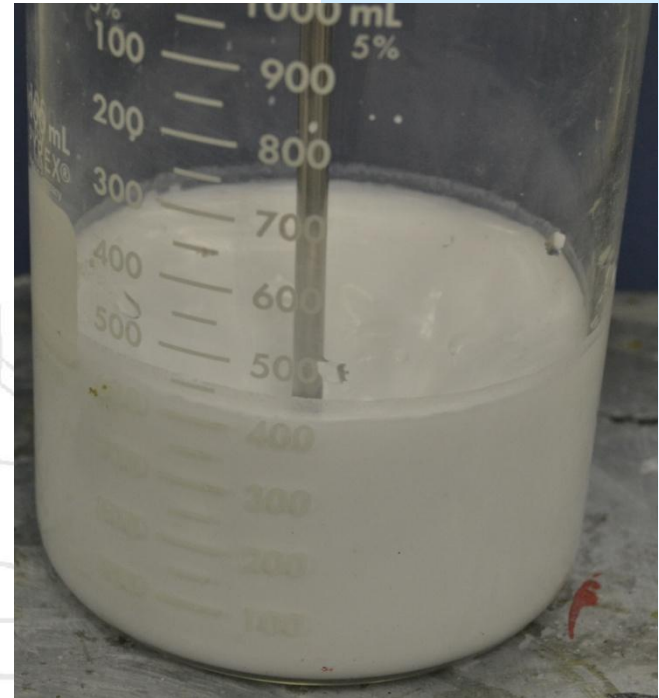
People were surprisingly Quiet

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Observation and Measurement

- Stage 1
- Run at room temperature
- Mixing process that blends powder and water
- Short lived intermediate stage
- *New Action*
- Record mix time and temperature



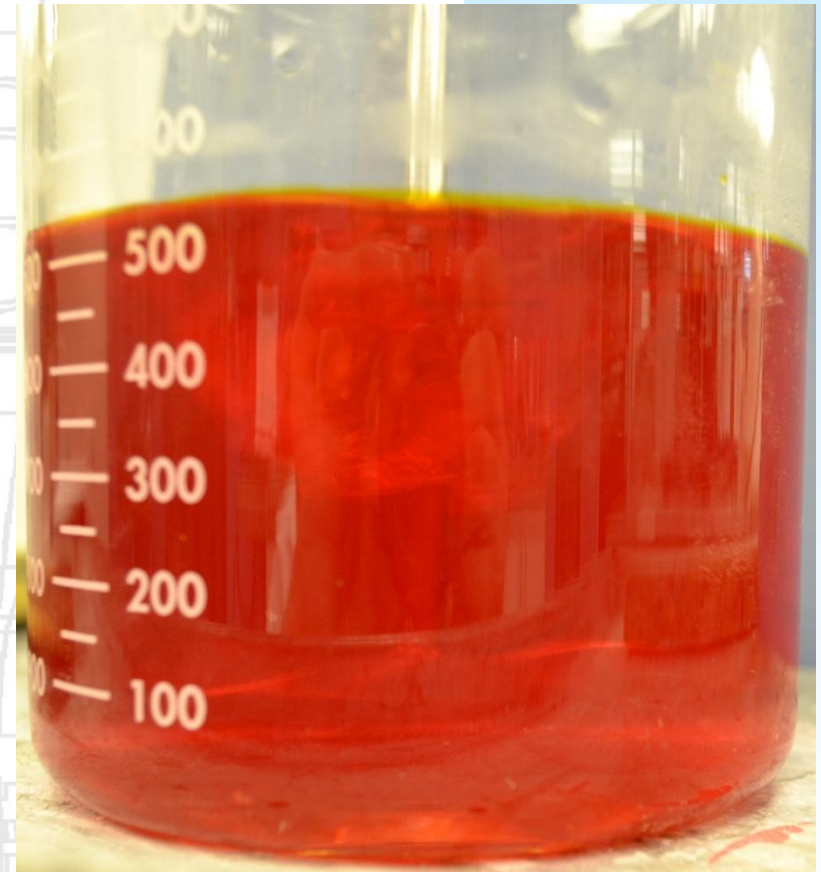
- Stage 2
- Colour change observed
- Temperature increases considerably
- Fault – no records from production
- *New Action*
- Record mix time and Temperature change
- Compare Factory and Laboratory results



- Stage 3
- Colour and temperature change
- Fault - No record
- *New Data*
- White spots represent a precipitate that must dissolve prior to any further additions
- This process is Time and Temperature dependant



- Stage 3 After an appropriate mixing period
- The precipitate is no longer present
- The clarity of the liquid changes to loose a slightly cloudy appearance



Breaking Tradition

- The Paint Lab uses nice opaque Stainless Steel containers
- The precipitate and subsequent gain in clarity were not reported in Laboratory Raw Material testing.
- The Manufacturing Instruction needed a significant re-think

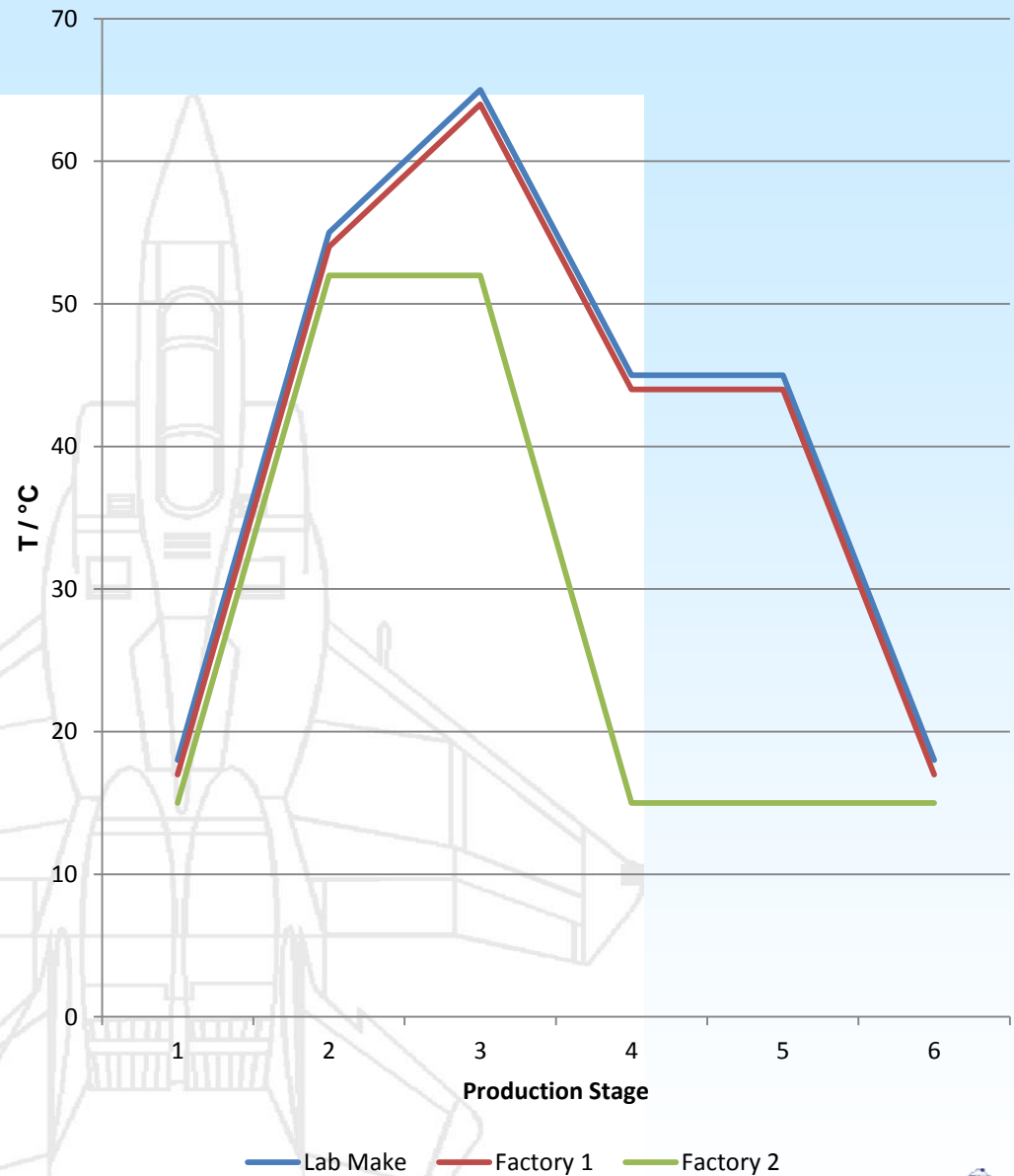


Time and Temperature Dependence

- Laboratory samples made as 1kg lots in a Stainless container can be processed a lot faster than 200kg Factory batches

- Allowing the liquid premix to cool to room temperature over night was not considered to be a process alteration

- This was not reported accurately as a result



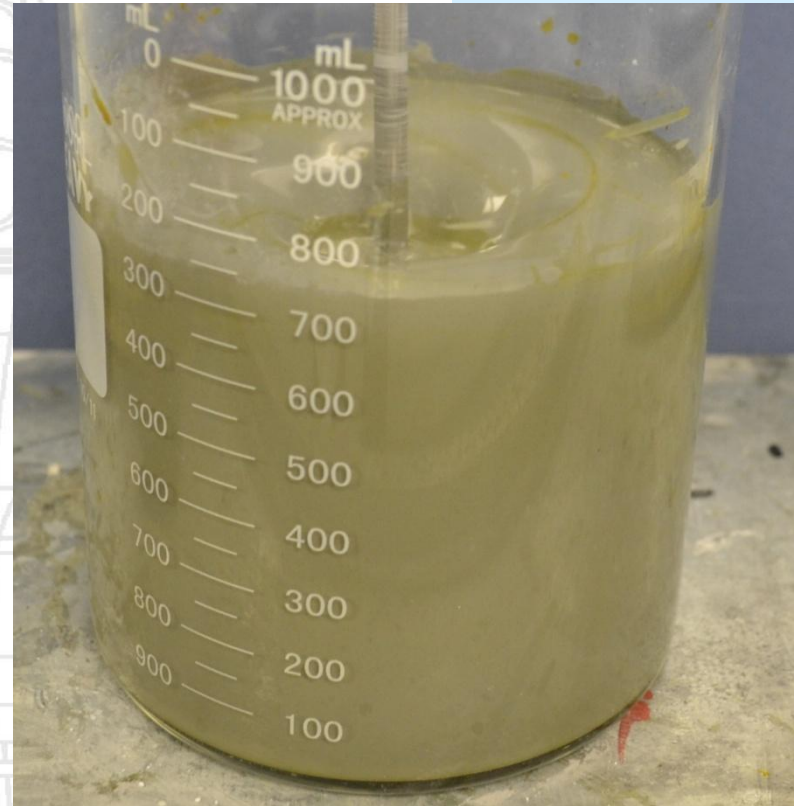
We Always Do It This Way

- **Production Staff**
 - ❖ **We always follow the instructions** – True because the instruction did not specify the mixer or the need to maintain specific temperatures
 - ❖ **We always use the same mixer** – True for each individual. When the four trained operators talked together differences were identified
 - ❖ **The Batch size never varies** - Fact
- **Laboratory**
 - **Production must have changed the process** – Too many assumptions left the process instruction open to interpretation
 - **The Raw Materials must be at fault** – No evidence was found to support this comment
 - **It works when we do it in the Lab** – Communication is Key. The assumption that the process was always run within one shift and an incomplete set of instructions led to the loss of simple but critical data.



Results

- The process instruction for the coating increased from 100 to 600 words
- A previously troublesome product now work first time every time
- **Our Manufacturing Staff now ask a lot more questions and routinely contribute to scale up and development of new products / processes**



Final Comment

- Past experience led people to forget basic principles of good science. Good observation and measurement.
- The past 25 years of coatings manufacture has seen a great deal of change
- Environmental Legislation and Politicians will dictate that there is more change to come
- Indestructible Paint is committed to projects that will remove Chrome from Organic and Inorganic coatings, we have Water Based products awaiting test
- Everyone from Raw Suppliers through to End Users can provide an input that will help our allied industries to meet future challenges

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