



Reducing The Collection Temperature of Gas Atomised Alloy Powders

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Introduction

Wall Colmonoy predominately manufacture Nickel and Cobalt Super Alloys form its European headquarters in Pontardawe, Swansea. This manufacturing route is in the form of atomisation using high pressure water or gas jets. During gas atomisation, there is a requirement to cool the powder through the process from its origin temperature of 1,700° C from the furnace, through the tower, pan ducting, and cyclone before finally being collected in a collection pod. Cooling jackets on the external of the components allow for cooling to occur to extract the heat from the process. Historically, Wall Colmonoy only had water jackets on the main chamber and had no means of keeping a constant inlet cooling temperature. This project was to overhaul the cooling system to allow water jackets to be used on all the components and allow a constant inlet temperature to reduce the final powder collection temperature, where historic averages were 224° C.

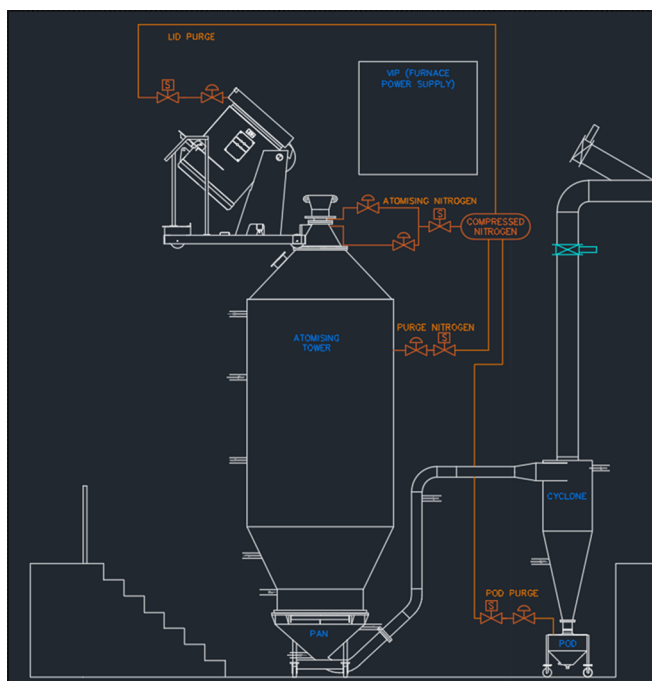


Figure 1 – Atomisation Schematic

Project Aims

The project had four key aims and objectives which ranged from health and safety improvements, to product quality and equipment reliability benefits.

The aims and objectives can be seen below.

1. Improve the health and safety around this process by eliminating burns risk.
2. Reduce losses due to pan sticking.
3. Improve product quality.
4. Prolong life of equipment.

Methodology & Results

The project was a DMAIC (Define Measure Analyse Improve Control) project. The problem was defined based on the collection and surface temperatures within a batch, and the oxidation occurring, shown as discoloration of particles.

Measuring the products characteristics was possible from Wall Colmonoy's laboratory. Operational data was recorded to identify the impact on losses due to pan sticking as well as powder and surface temperatures. Sales data was measured to appreciate the sales opportunities missed due to poor product quality.

The analysis phase discovered the yearly losses were £32k, and pan sticking was 50% of this figure. It was observed that the pan glowed 'red hot' during some batches. The lab rejections detailed that oxygen failures were the highest rejection out of four total rejection categories.

A specialist was hired to calculate the required flow rates and temperatures to achieve a powder collection temperature of 50° C. This required cooling jackets on all components, where new fabrications were required for all except the tower. By installing an adiabatic cooler onto the circuit, it allowed for constant feed temperatures to be less than 25° C.

The control stage quantified the improvements made by having additional water through the system. It was determined that the powder collection temperatures reduced from an average of 224° C to 69° C. Losses due to pan sticking reduced by 52%. Visual oxidation reduced and there was improved morphology, which increased the circularity of the particles by 44%.

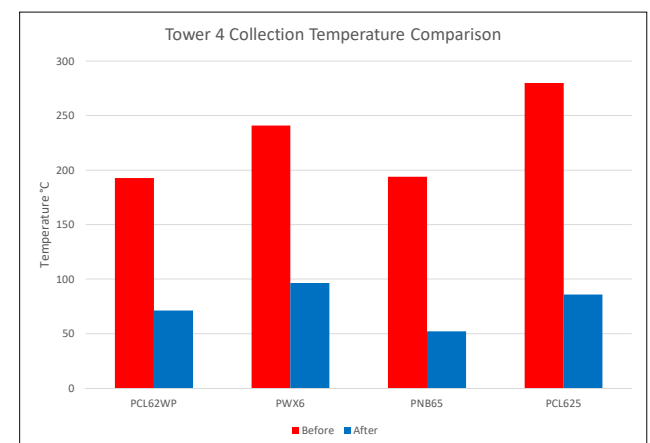


Figure 2 – Powder Collection Improvements



Figure 3 – Losses Improvements

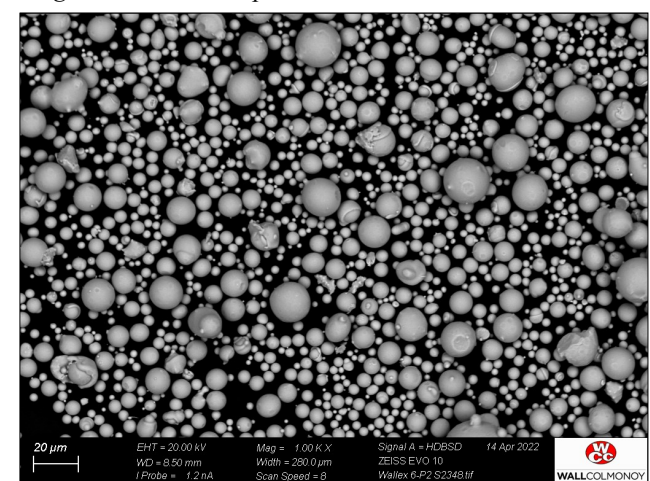


Figure 4 – Morphology of Improved Powder

References

- Yule, A. & Dunkley, J., 1994. Atomization of Melts: for Powder Production and Spray Deposition. Oxford Series on Advanced Manufacturing: Oxford University Press.
- Dunkley, J., 2002. Anti-Satelliting for Powders Produced Inert Gas Atomisation. Materials World , 10(7), pp. 24-25.