WEBINAR FAQs

Thank you for joining our webinar "What to Consider When Selecting your Aluminum Powder for AM Applications". We had a lot of great questions but unfortunately, didn't have time during the webinar to get to them all. So, below is an extract of frequently asked questions.

1. **You mentioned a relationship between gas pressure and retained porosity in powder particles - is this referring to the gas pressure used in powder production, the laser powder bed fusion process or the hot isostatic pressing stage?**

This refers to the gas entrapped during the gas atomization process. The gas entrapped in these particles will remain after part consolidation. The hot isostatic pressing (HIP) process will reduce the pore size, increasing the printed part density.

However, the entrapped gas might remain in the part in a very reduced space at high pressure, which may have detrimental effect on mechanical properties of the part, notably on fatigue properties.

2. **Cracking due to residual stresses: But what about solidification cracking occurring due to structural 6XXX Al series? Have you considered these alloys as well while printing? The cracking picture shown in slide, I think was from 6XXX Al alloy.**

That's is correct. As mentioned during the webinar there are multiple challenges for the aluminum alloys on additive manufacturing field.

There are series of alloys that are not weldable such as the 7XXX series, to mention just one. There is a lot of effort among the additive manufacturing community to develop the technique and to make them processable, but we are not there yet. The cracking image shown during the webinar was for a 7XXX series material.

3. **For F357 AL Mg, which mechanical properties do you attempt with additive manufacturing and with which heat treatment?**

The final properties of the printed part are a balance between powder properties and machine parameters optimization and further post heat treatment.

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AP&C AlSi7Mg (F357) powder has been used in Concept Laser machines and has met and exceeded the AMS 4289 mechanical requirements. Regarding heat treatment, at a minimum, a T6 heat treatment is normally recommended for AlSi7Mg parts. Hot isostatic pressing (HIP), particularly for fatigue limited applications, may also be considered to improve properties. As a note, AMS 4289 does not include a HIP process.

4. What is the level of porosity obtained for GE F357 and AlSi10Mg powders?
AP&C AlSi7Mg and AlSi10Mg, based in metallographic image analysis of the powder, particles have a density between 99.99 and 99.98%. Depending on parameter settings within an additive machine, porosity levels in final parts will vary.

5. What percentage of fines in powder may be expected? Less than 15 micron?
AP&C recommends a max of 8% of less than 15 µm for a standard product of 15-63µm.

6. 10mg and 7mg powder - which one is better of heat exchanger material?
Both alloys are typically used in aerospace applications. Suitability depends on application needs. GE Aviation currently utilizes AlSi7Mg to manufacture heat exchangers for the GE9X engine.

7. What powder characteristics deteriorate most with repeated recycling?
Every additive manufacturing process is different and even for similar platforms of laser powder bed fusion it may work under different conditions. That means that the powder may degrade differently. Potential forms of degradation are changes in particle size distribution (PSD) and morphology as well as the oxygen content, then the physical properties as flow may be affected.

8. How much evaporation compensation is made on the feedstock chemical?
The un-melted powder is not at an elevated temperature. So, the evaporation phenomena may happen only at the melting spot. However, this effect is minimal, and the chemistry of the printed parts is very comparable to the raw material, inside of the range of the permissible variable of the chemical analysis test.

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9. Does AP&C use image analysis systems to analyze morphology?
AP&C characterizes the morphology by following the ISO 9276-6 definitions and methodology. Micrography is taken using an optical microscope and further image analysis is done with specialized software.

10. Can you elaborate more on hipping of aluminum parts? Is it worth it?
Many users perform hot isostatic pressing (HIP) of aluminum printed parts.

However, it depends on final part mechanical requirements. Different laser powder bed fusion platforms recommend different heat treatments for the printed parts. HIP treatment may also help to homogenize the mechanical properties of the part in any direction, reducing the natural texture effect of additive manufacturing technologies.