What to do for Increase Mechanical Properties of Aluminum alloy in HPDC

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In Casting process, Mechanical Properties of any alloy are based on, 1/ **Microstructure** of alloy during solidification and during 2/ **Heat treatment** (when require).

1/ **Microstructure** is influenced by chemical composition in alloy and by solidification condition used. Different factor can be identify, like size and form of dendrite primary and distance between dendrite (DAS), the structure of Si eutectic, associate with modification or not, element intermetallic due at presence of Cu, Fe and Mg.

2/ **Heat treatment** of homogenization, for dissolve Cu and Mg inside of matrix, and annealing cycle for precipitation and adjustment of intermetallic element.

Before any work on structure we need to be sure, all other reason to reduce mechanical properties will be eliminate, and our process will be fully capable to repeatability and stability.
In HPDC (High Pressure Die Casting), the alloy used for produce parts have an important impact.
The principal factors, who have an impact on mechanical properties are:
- **Metal**: Preparation, chemical composition
- **Die**: Temperature, lubrication, type of treatment of die.
- **Machine**: Pressure, alignment, parallelism.

We oriented our analysis on Metallurgical Structure and the type of process who can impacted the structure.
We have direct relation between structure and mechanical properties, it’s for that we oriented our analysis on 3 different points:
1- Type of alloy,
2- Metal preparation,
3- Production Process,
In HPDC for increase mechanical properties, we need to control and choice the type of alloy and put fully under control our alloy at reception for warranties repeatability in the next operations.
By our capability to maintain in permanent control our process, we are able to implement and measure the impact of SIMP, System for Increase Mechanical Properties, on our production.

Produce part by HPDC with high mechanical properties require to have a good alloy with good chemical composition, good die and good machine.
During metal preparation we must control, melting process, transfer, holding temperature and time, and during injection have a full control of alloy in chamber and in die by using specific process, SIMP.

When the process is fully stable and capable to stay stable we are able to improve the structure of alloy and Increase Mechanical Properties by using SIMP.

By this way, we are able to increase 30% of mechanical properties of any alloy.
Improvement of Mechanical Properties in HPDC can be possible if we control Metal preparation and process modification.

What we consider for metal preparation?
In HPDC, we have the common idea, to compensate the problem of porosity by increasing the injection pressure. It’s sure this help, but porosity stay porosity, by increasing pressure we can reduce the size of porosity but never eliminate. One micro porosity reduce mechanical properties.
Presence of oxide in side of alloy reduce mechanical properties and generate defect.
Presence of Inclusion generate hard spot and reduce mechanical properties.

Metal preparation have for objective to eliminate a maximum of gas, oxide, inclusion and reduce the risk to deteriorate Mechanical Properties.
By a strong metal preparation we reduce a risk of presence of inclusion, oxide film and gas due at Hydrogen.

Less quantity of inclusion, oxide element and gas, help to maintain mechanical property of alloy at level show by aluminum product supplier.

The real objective in metal preparation is to create the best condition inside of metal for achieve best potential and optimum condition for good mechanical property.

But we must understand, this 1\textsuperscript{st} activity is only a \textit{basis of requirement} for best potential of alloy.

If we want Increase the Mechanical Properties we need to add other concept for change the alloy structure and be able to have better YS and E\%.

We are using \textit{SIMP, System for Increase Mechanical Properties} in each die and adapt at each part and cavity this process.
**What we consider for process modification?**
At 2A, we modify our process for Increase Mechanical Property, by using SIMP Process, and create a new concept of die by implemented inside of die. We are working on stabilization and repeatability of our process for achieve in best condition our SIMP. We are working on each area, where we can have an impact on structure of alloy before and during injection.

**What we can do for better support of our customer?**
In complement of this presentation we are developing some new concept for increase the die life, for use core loss, for use new alloy by transfer GDC alloy in HPDC, by using metallic core (patented process per 2A), by creating some new partner ship with product alloy and use the Silafont 36, Silafont R and Magsimal 59 and by using glue assembly process for specific application (patented process per 2A).
We hope, this presentation can help you to understand the possibility you can have with us, to use classic alloy and get a better value of mechanical properties by using our SIMP process.

For any other explanation, please contact us, we will give you the answer concerning the technical reason and concept apply at 2A.
Thank you for your attention!