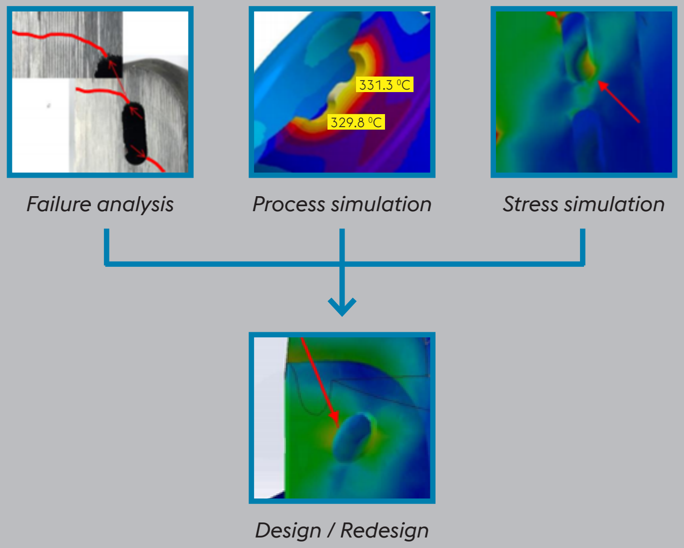
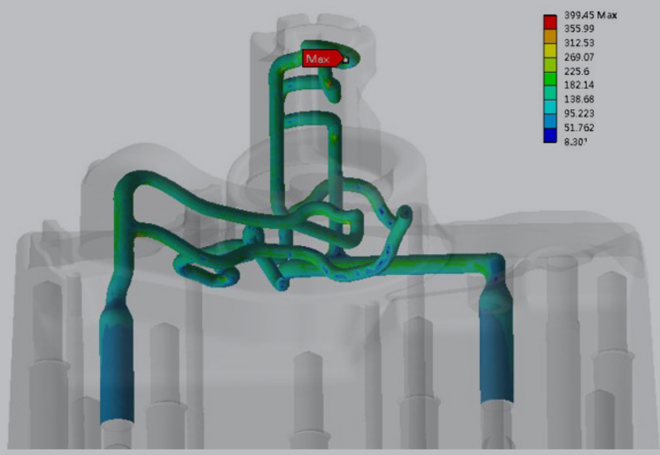


Failure analysis, process & stress simulation are the base to optimize cooling channels



Stress analysis of an optimized high pressure die casting tooling insert

HIGH PRESSURE DIE CASTING

The Importance of Design for AM

A TOOL FAILURE CAN HAVE MANY DIFFERENT CAUSES. A DEEP UNDERSTANDING OF TOOL DESIGN AND MATERIAL PROPERTIES IS ESSENTIAL WHEN USING ADDITIVE MANUFACTURING TO OPTIMIZE HIGH PRESSURE DIE CASTING TOOLING.

PROBLEM

Additive Manufacturing is an emerging technology, but despite the obvious benefits when adopting AM, a knowledge gap remains across the tooling industry. We have identified three common problems tool designers face when looking to adopt Additive Manufacturing for the first time:

- » Designers may apply conventional or traditional design rules to conformal cooling designs.
- » Designers may not have a clear understanding of the applicable design rules they should follow when designing for AM.
- » Designers may not be aware of the mechanical loads and the potential negative impacts they may have on the tool.

SOLUTION

As a solutions provider to the High Pressure Die Casting industry, we work closely with our customers to optimise tooling specifically for their production processes. If our customer has an existing production issue, our HPDC experts can perform failure analysis on the tool to determine the root cause. We put all of our know how into design, materials and printing to deliver maximum performance.

SUMMARY

While many HPDC failure modes such as Soldering, Heat-Checking, and Erosion can be prevented by selecting a premium material such as BOHLER W360 AMPO, crack initiation often starts in areas with the highest mechanical stress loads. Only the right design, combined with the right material can deliver superior tool performance.

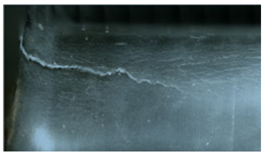
PROVEN CUSTOMER SUCCESS

Case 1: Part failed because of cracks

Competitor AM insert failed after 3.000 shots

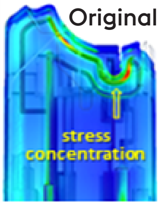
Failure analysis

Crack starts inside the cooling channel and insert failed due to high stress concentration



Stress anylsis

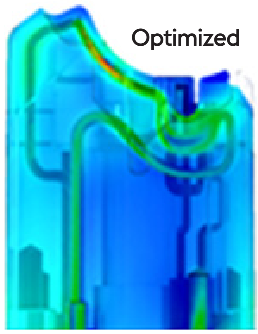
thermo-mechnical stresses



Conclusion: stress concentration exactly where the crack startet

Solution

Redesign - Stress was reduced by over 50%.



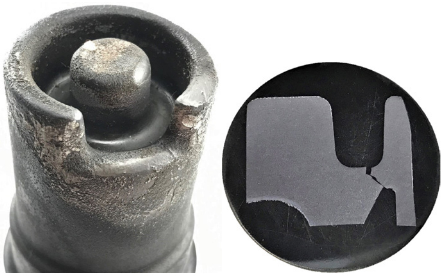
Results

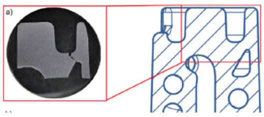
Conventional Tool 1.2343: 20.000 shots

AM design competitor: 3.000 shots

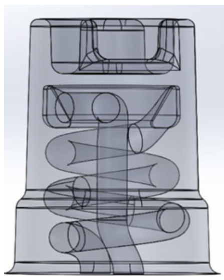
voestalpine AM design: 60.000 shots

Case 2: Part fail because of soldering and cracks which leads to a leakage in cooling system

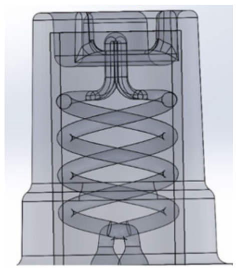




Previous design



New design

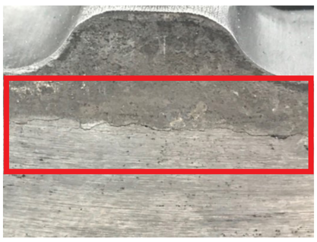


less soldering and stresses

Results

The original design didn't minimize the stress level. Therefore the crack started from the area in the cooling channel with high stresses. Via redesign of the channels the stress could be significantly be reduced and the cooling even improved.

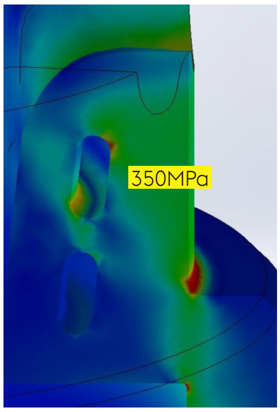
Case 3: Part failed because of cracks



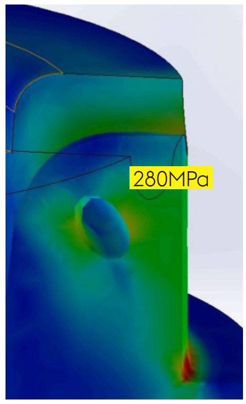
Failure analysis

Cracks initiated from the cooling channels lead to leakage and to part failure. Stress analysis showed the highest thermo-mechanical stresses exactly in the area where the crack started.

Original



Optimized



Results

Adjusted redesign to reduce the maximum stress by 20% while keeping the cycle time and cooling rate

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ONE STEP AHEAD.

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