

Super-Moulds seminar

21st of January 2020

The way to a successful injection moulding production

Michael Lundbech - CEO

MICHAEL LUNDBECH A/S

Outline

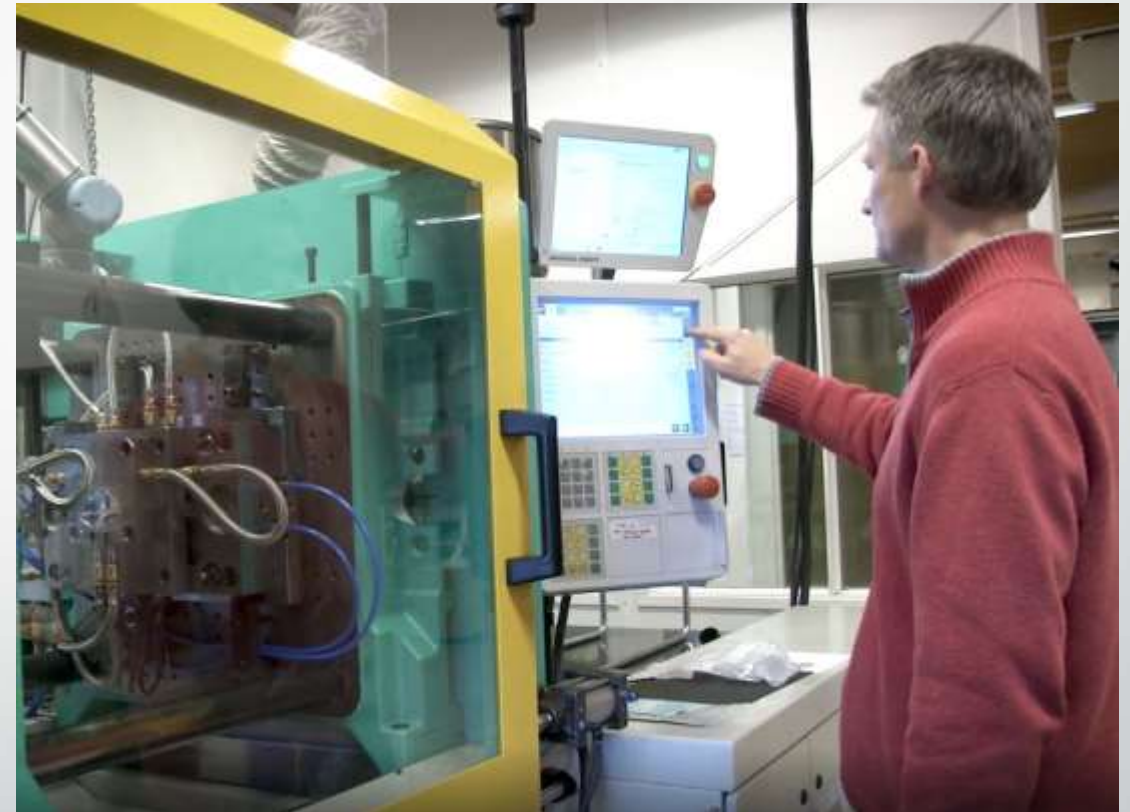
- Company, and role in project
- Case – tool, material, moulding process
- Test performed at ML
- Conclusion

- **Michael Lundbech A/S** – A provider of high-tech mould solutions for customers all over Europe. The company offers all relevant services associated with mould making, such as development, prototyping, simulation, part optimisation, mould design, mould manufacturing, testing / production and servicing of tools for injection moulding.



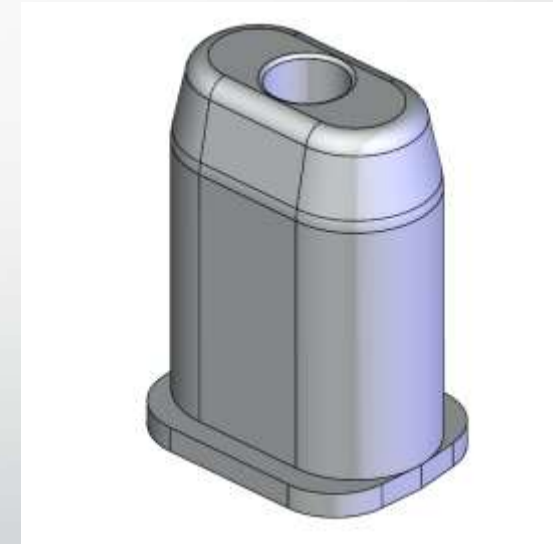
**Michael Lundbech A/S
participate in Super-Moulds
project**

**Role:
Finding cases where
demoulding is an issue, and
then test them with the
results from the Super-
moulds project.**

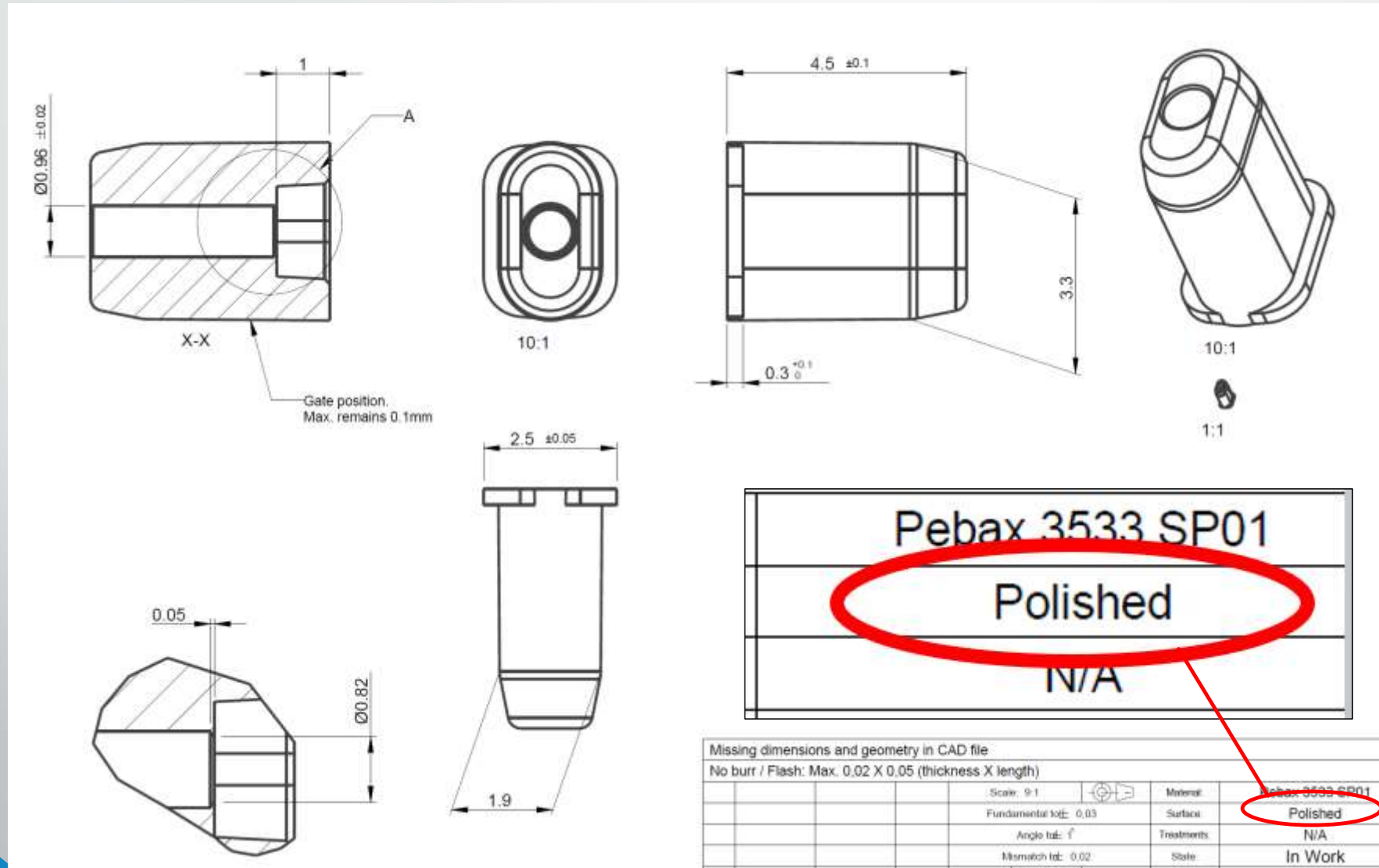


Michael Lundbech A/S case for Super-Mould

- Part dimensions and demands
- Mould description
- Materiel : TPE - Pebax 3533 SP 01 resin
- Identification of challenges with molding of the part



Part dimensions and demands



CAMPUS® Datasheet

Pebax® 3533 SP 01 - TPA
ARKEMA



Product Texts

Pebax® 3533 SP 01 resin

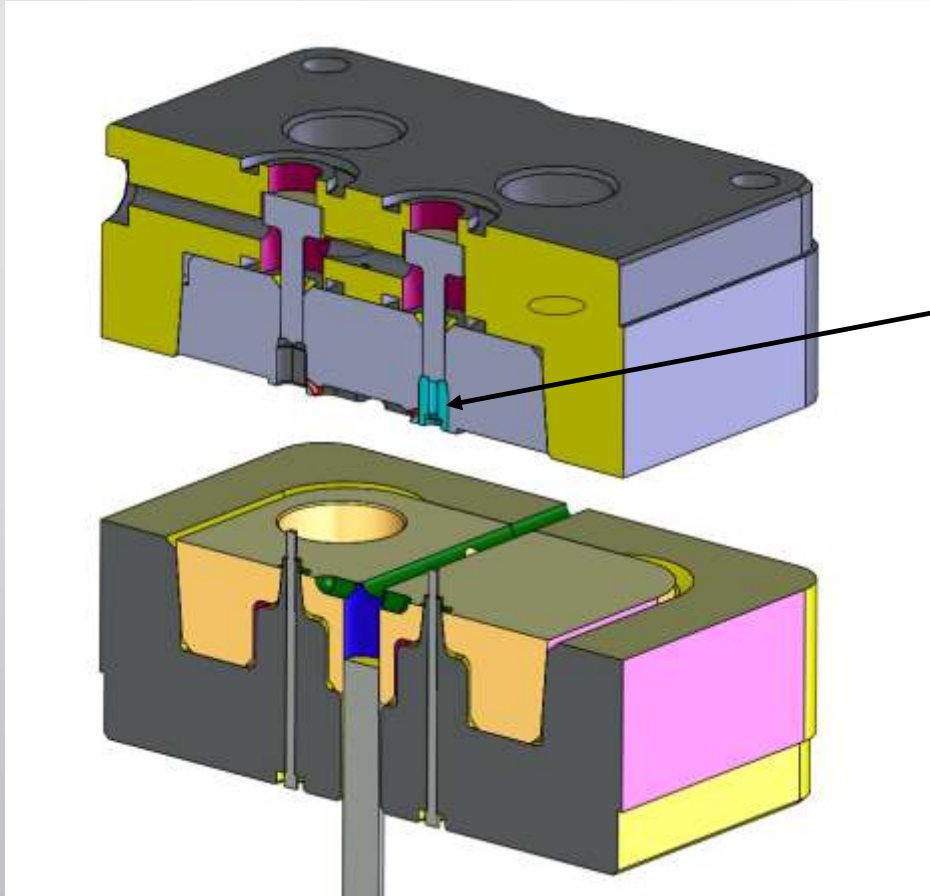
Polyether block amide **Pebax® 3533 SP 01 resin** is a thermoplastic elastomer made of flexible polyether and rigid polyamide. This SP grade has been developed to be heat and UV resistant.

Main applications:

- Flexible injected parts.
- High performance power transmission belts.
- Silent gears.
- Toy component.

- Material critical key point :
 - Very sticky to cavity surfaces

Challenges with molding of the part

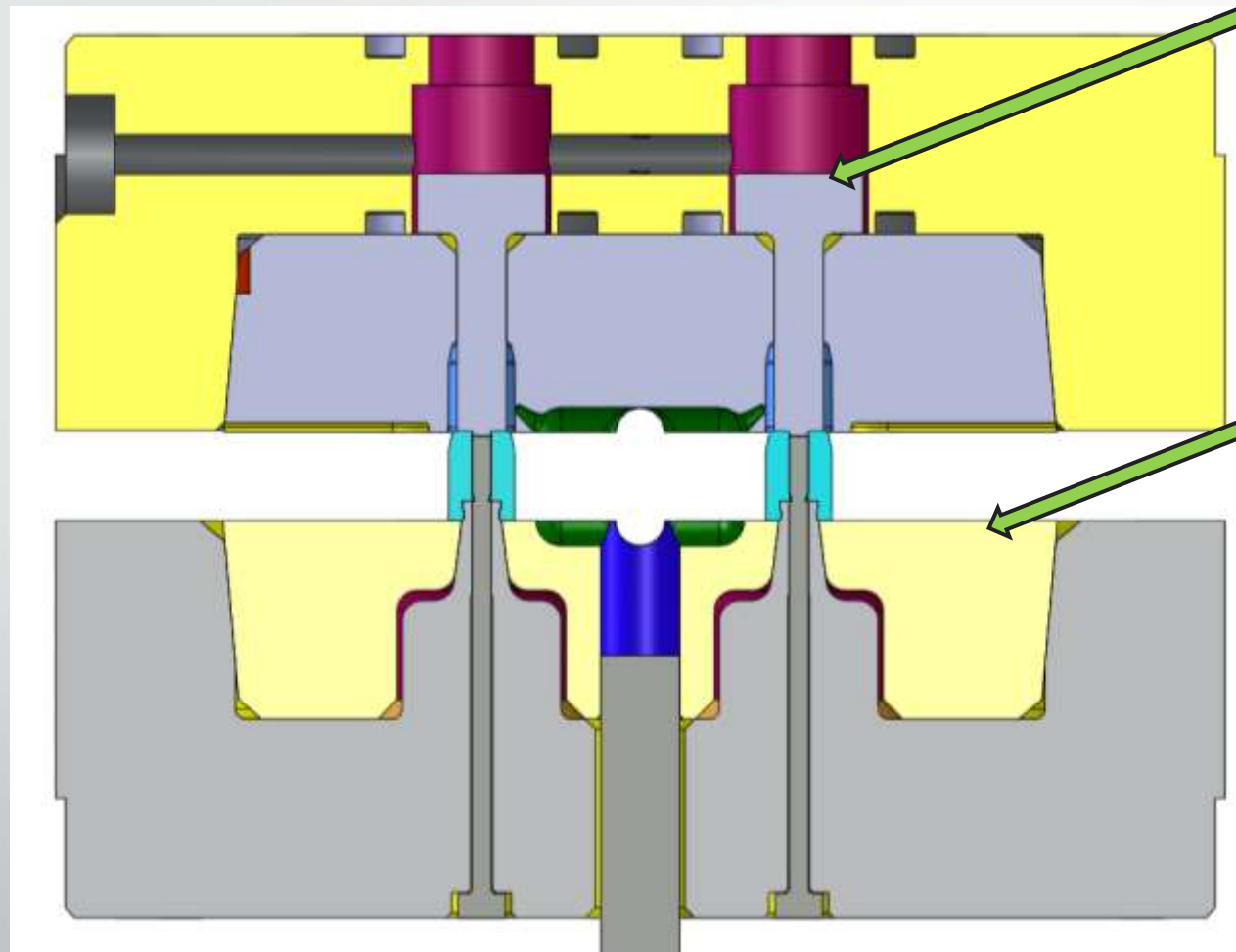


- The part sticks to the fixed side during mould opening

Demoulding



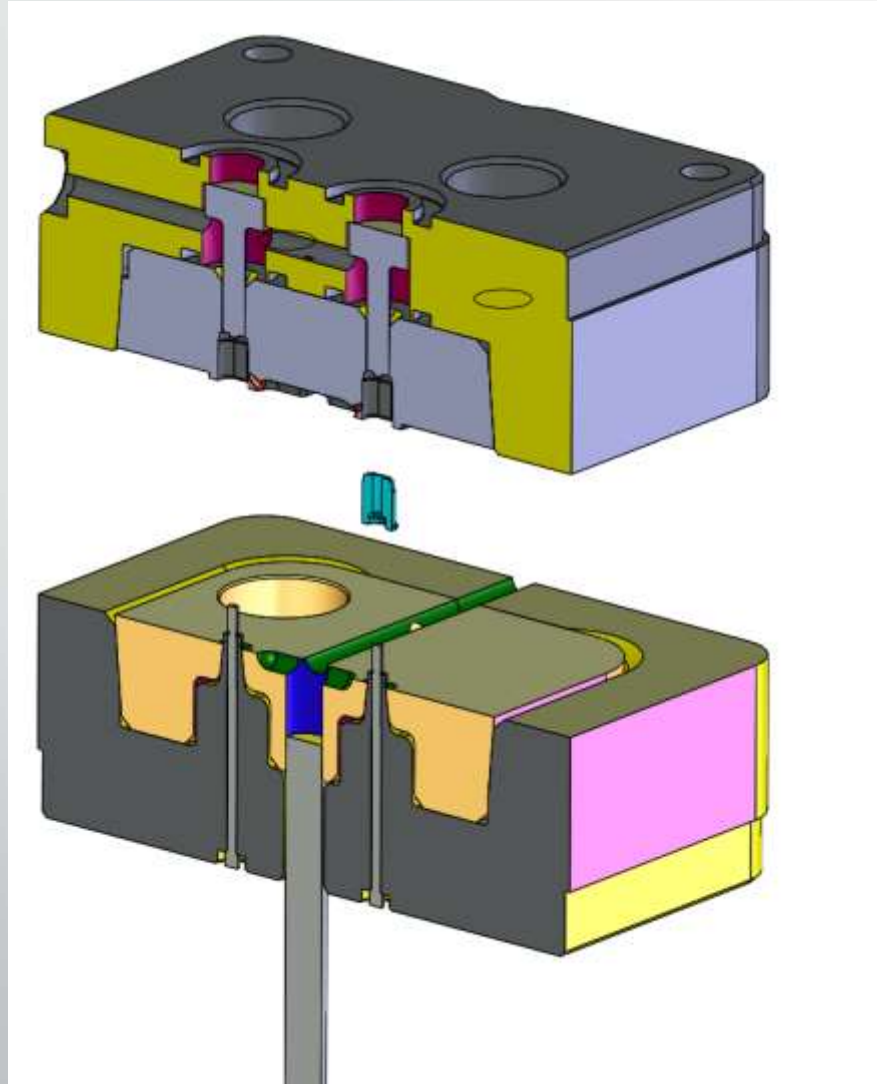
Mould concept Demolding steps



Air push cores forward in fixed side.

Stripperplate push the parts of the cores.

What have been done



- The surface in fixed side have been changed from polished to a VDI 18 – No change
- The core have been moved from fixed to moveable side – No change
- The surface on the core have been changed to milled, grinded and VDI24 – No change
- Movable cores were added in fixed side to push the part out – No change
- To be able to mould the part we have rework the surface in the fixed side to VDI30
- After making the VDI 30 the part is no longer transparent, and cannot be accepted by the customer

Process parameters

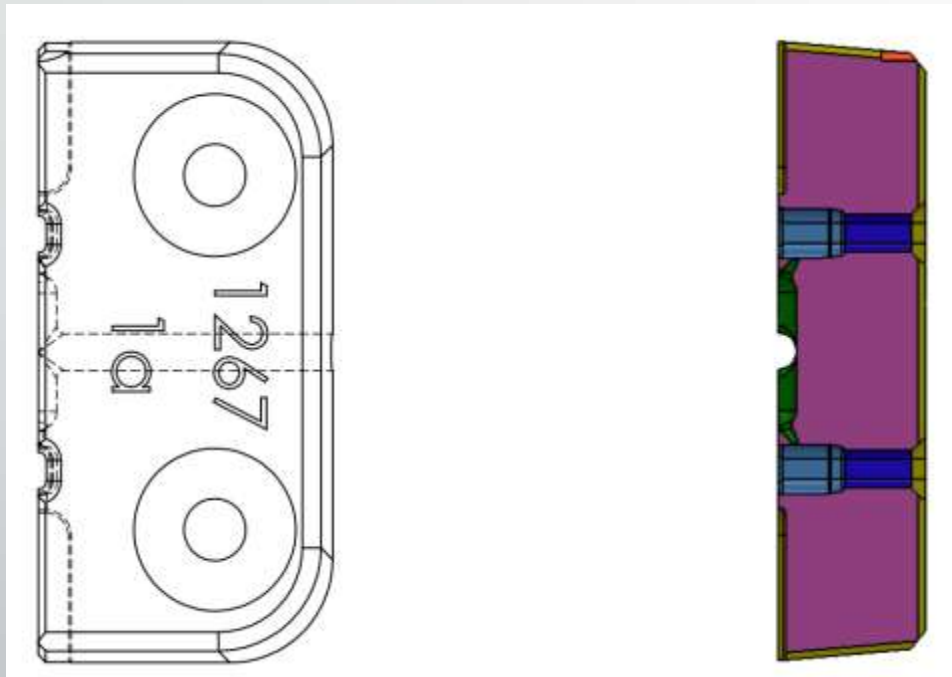
5 Indsprøjtning								
Indsprøjtningstrin	Omk.	Trin 5	Trin 4	Trin 3	Trin 2	Trin 1	Start	
Position	7,0					23,5	16,0	mm
Indsprøjtningshastighed						50		mm/s
Max till. sprøjtetryk	2.200	bar	Omkoblingspunkt	7,0	mm	Restpude	0,0	mm
6 Eftertryk								
Valgt eftertryksprofil	Trin 6	Trin 5	Trin 4	Trin 3	Trin 2	Trin 1	Start	
Tid				0,1	2,0	0,1	0,0	s
Eftertryk				400	400	25		bar
7 Bevægelser								
Værktøj åbning	Trin 6	Trin 5	Trin 4	Trin 3	Trin 2	Trin 1	Lukket	
Position				150	145	15	0	mm
Hastighed				150	200	15	0	mm/s
Værktøj lukning	Åben	Trin 1	Trin 2	Trin 3	Trin 4	Trin 5	Trin 6	
Position	150	145	25	20				mm

Except from the transparency the quality of the parts was acceptable with a holding pressure of 400 bars.

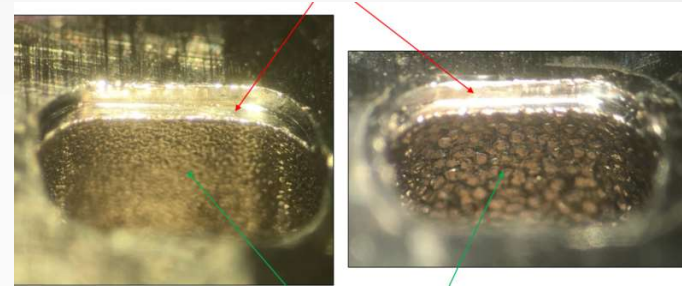
Conclusion :

After a lot of attempts with no positive results, the end was to make a complete new mould concept with sliders.

Split Insert for Lasertexturing and Coating



3DS EDM in existing inserts, made by
AgieCharmilles SA - Georg Fischer
Machining Solutions (CH)



Lasertexturing in new split inserts, made by
AgieCharmilles New Technologies SA -
Georg Fischer Machining Solutions (CH)



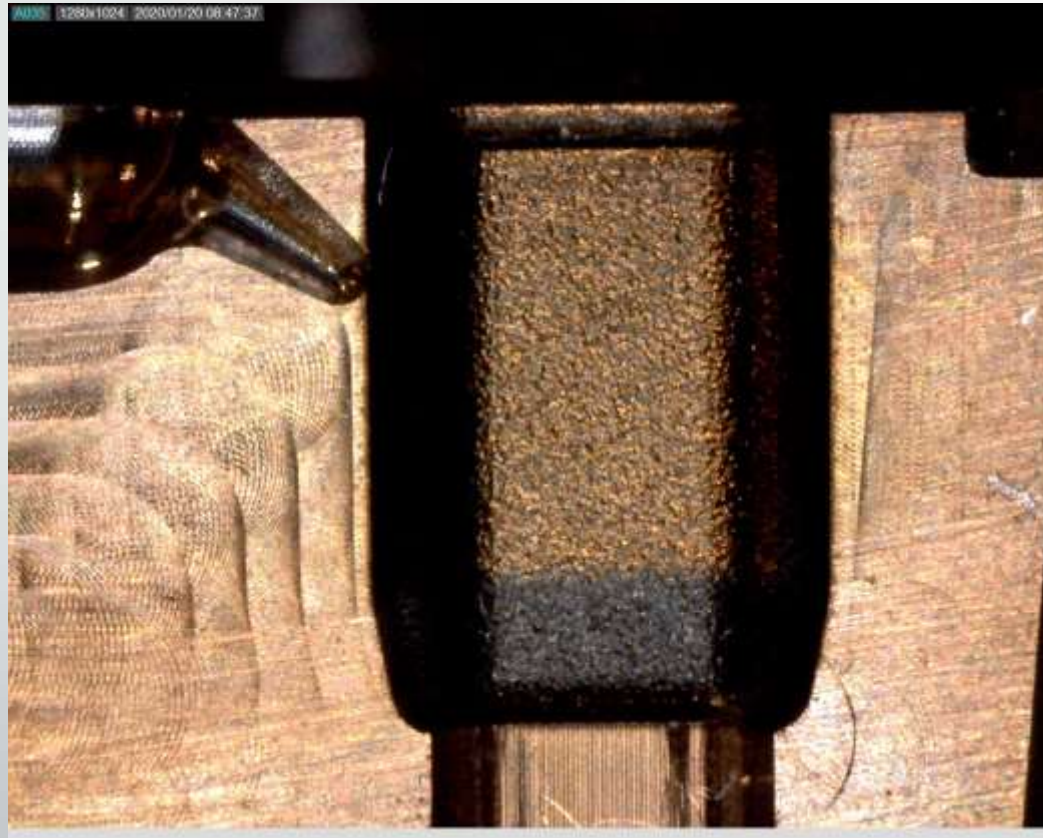
Coating in new split inserts, made by
Danish Technological Institute,
Tribology Centre



List of inserts for test

	3DS - EDM	Laserstructuring	Coated	
ML inserts no. 1			HiPIMS-CrN	Smooth and dense chromium nitride
ML inserts no. 2			Si-DLC	Siliciumdopet diamond-like carbon
ML inserts no. 3			HiPIMS-CrN - ion-ox1	Smooth and dense chromium nitride, implanted with oxygen ions
ML inserts no. 4		Strategy 2 - Sa 0,86 - with remelt		
ML inserts no. 5		Strategy 1 - Sa 0,76		
ML inserts no. 6	3DS - 7			
ML inserts no. 7	3DS - 3			
ML inserts no. 8	3DS - 5			

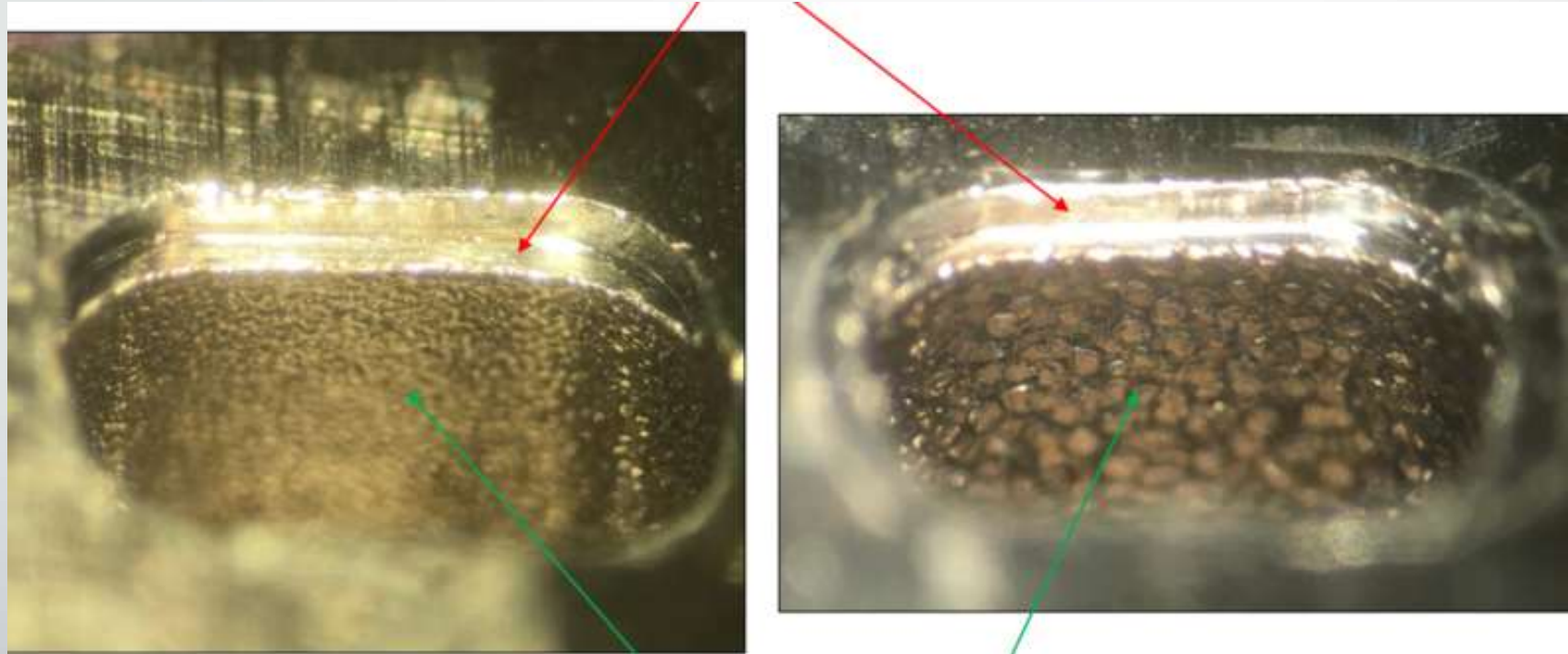
Test of Laser textured inserts



The test was negative, and no improvement of the demoulding could be observed



Test of inserts with EDM 3DS texturing



The test was negative, and no improvement of the demoulding could be observed

Transparency was improved with 3DS EDM



Ref.1 (new part)



Ref.1 – Old part

Test of inserts with Coatings



The first test was with Si-DLC coating
This was negative, and no improvement of the demoulding could be observed

Test of inserts with Coatings



The second test was with HiPIMS-CrN coating

This was positive.

Improvement of the demoulding could be observed up to 300 bar holding pressure, automatic run.

The third test was with HiPIMS-CrN with one dose of implanted oxygen ions coating.

This was very positive and the best test. Improvement of the demoulding could be observed up to 600 bar holding pressure, automatic run.

Conclusion of moulding test

		Holding pressure					
		100	200	300	400	500	600
EDM	3DS - 7						
	3DS - 5						
	3DS - 3						
Laserstructure	Strategy 1 – with an Sa 0,76						
	Strategy 2 – with an Sa 0,82 and remelted surface						
Coating	Si-DLC (intermediated Si content)						
	HiPIMS-CrN						
	HiPIMS-CrN with one dose of implanted oxygen ions						

Future work:

In the near future we plan to do a long-term test to determine that the coating is valid for production

Thank you for your attention!

Questions?