



EFRC  
EUROPEAN FEDERATION  
FOR ROTATING EQUIPMENT  
CONFERENCE 2018

3<sup>rd</sup> International Rotating  
Equipment Conference

## Closing the Innovation Cycle in Lightweighting Compressor Pistons

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## „Piston lightweighting“

Looking for affordable, drastic mass reduction

TNO WDynamics

TU Delft  
Delft University of Technology



Cyril Wentzel, Wentzel Dynamics, Netherlands

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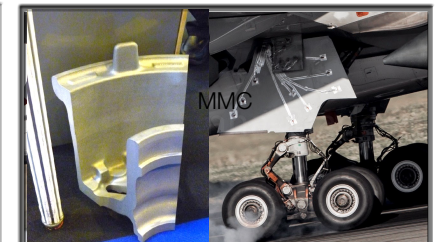
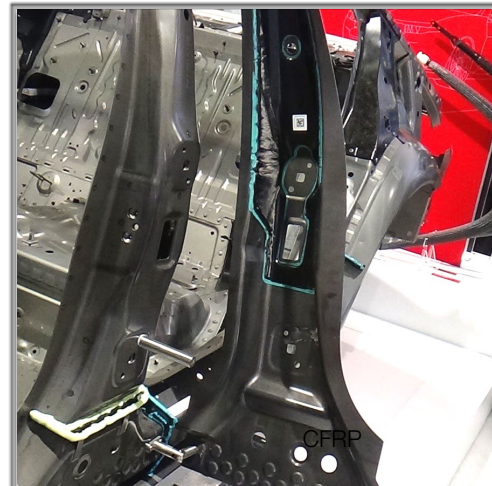
## Why?



- Current practice
- Benefits and previous attempts
- SAMPE versus SAMPSE
- Fatigue strength design driver

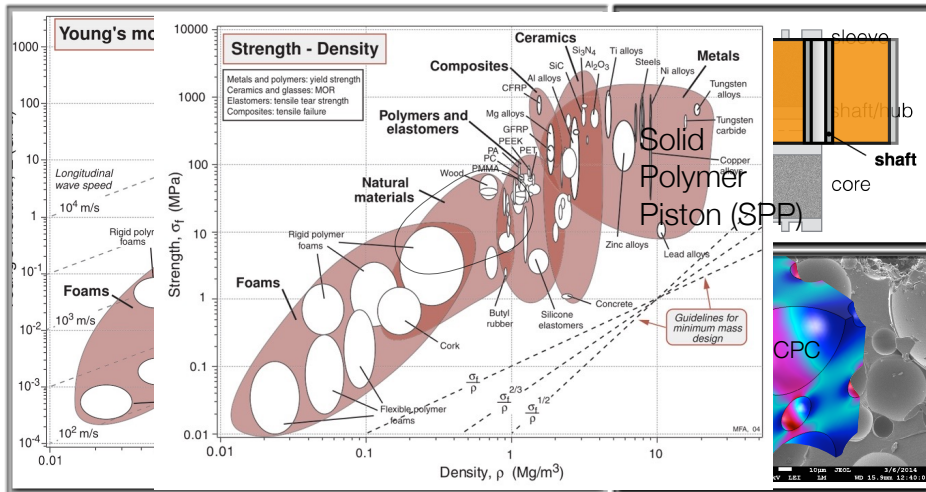
Cyril Wentzel, Wentzel Dynamics, Netherlands

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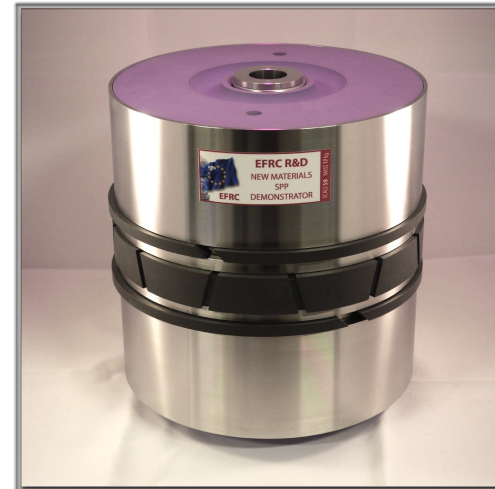


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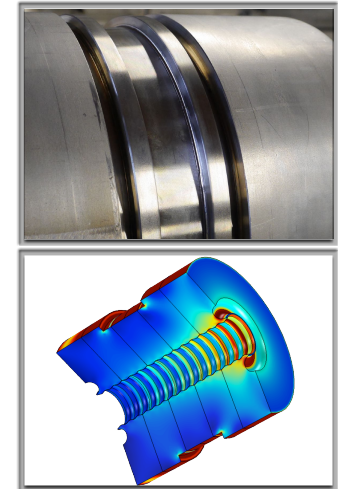
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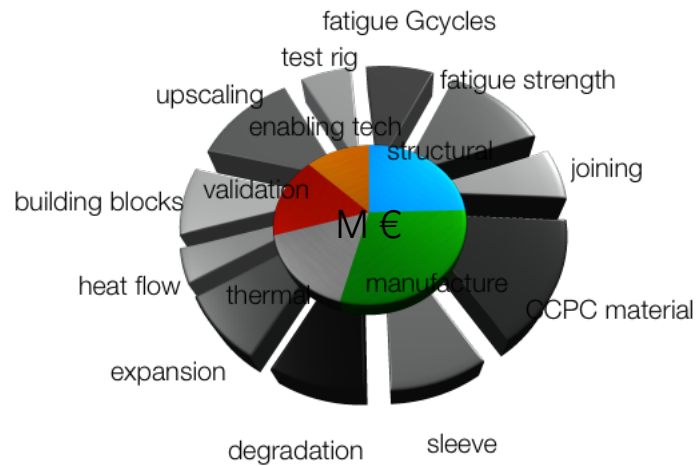
Cyril Wentzel, Wentzel Dynamics, Netherlands



Cyril Wentzel, Wentzel Dynamics, Netherlands

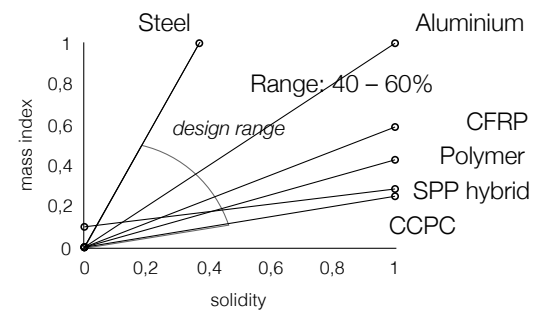


## Requirements, Aspects, Work



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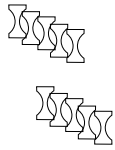
## Mass Reduction



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## Pre-Competitive R&D demarcation

Pre Competitive



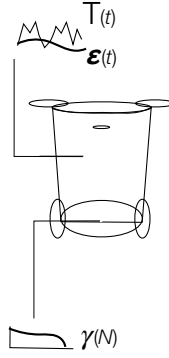
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Competitive:

manufacturing (\$)

materials (\$, Temp.++)

sleeve slimming (Mass)

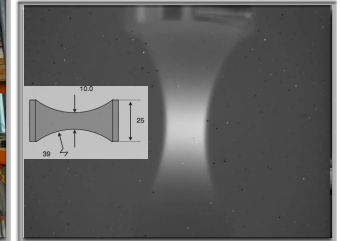
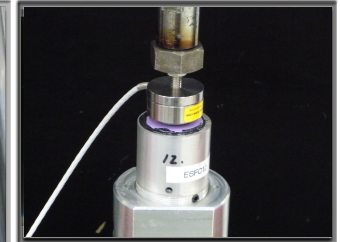
stress control

design method

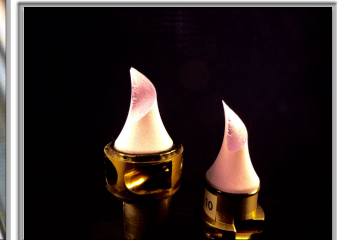
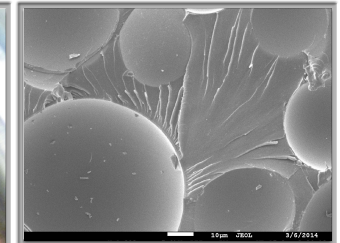
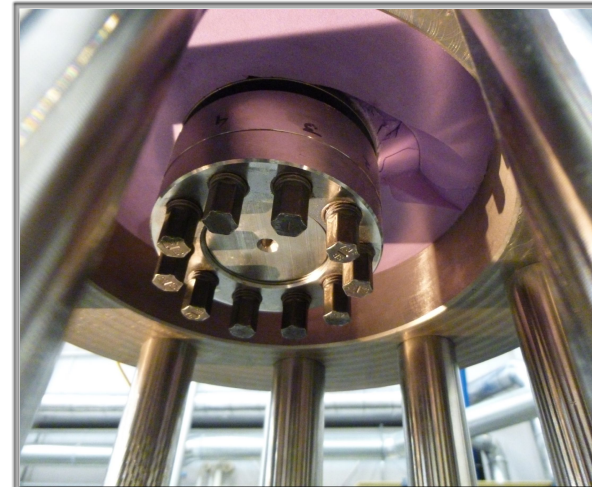
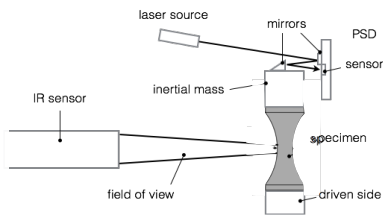
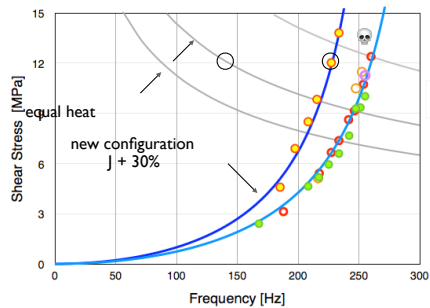
cooled piston rod

shaft integration

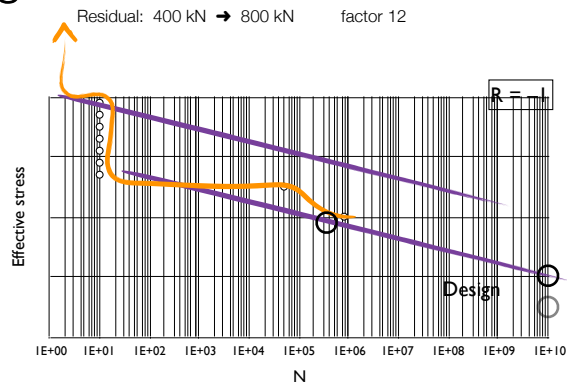
etcetera



## High speed torsional fatigue test



# Results



# Conclusions

- New material technology has been made available for dramatic weight reduction of compressor pistons
  - SPP conceived for structural and manufacturing simplicity & affordability
  - Validation of SPP concept has been obtained for simplified conditions
  - Pre competitive level R&D with follow-up, enabled by non-public funded EFRC
- Benefits of approximately 50% mass reduction can be many  
...and will become clear in the near future
- Fundamentals were provided for imminent application

# Questions?

Slides 16–26 available for discussion

- Benefits
- Cost
- Adaptations
- Thermal performance
- Stress states
- Load diagram in full scale test
- Reference designs & reduction
- Large pistons
- Where to order

# Closing the innovation cycle

