

# Hot Cracking in Cast Alloy 718

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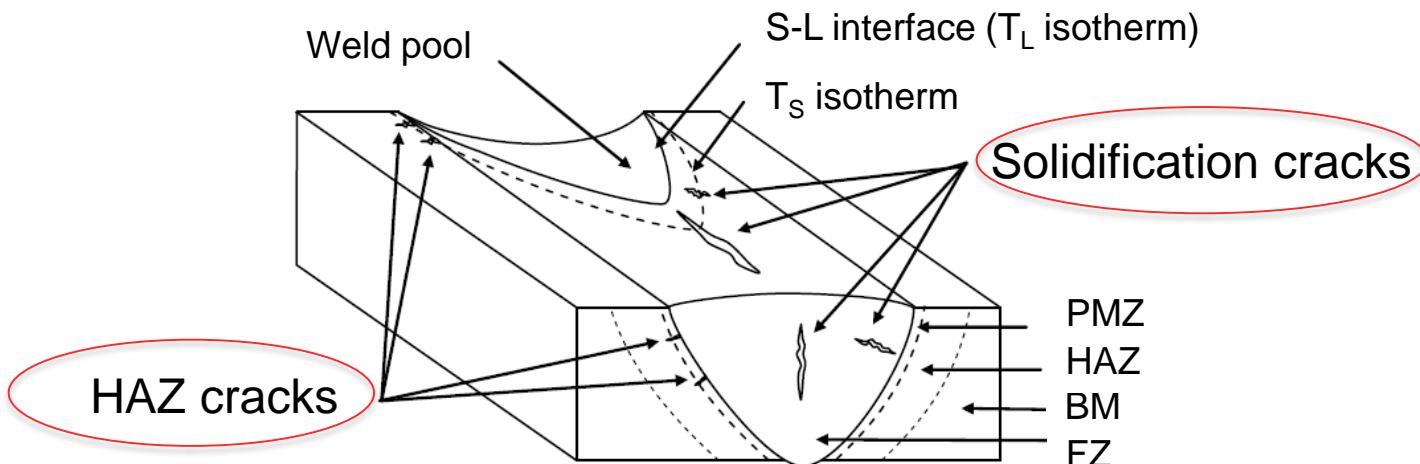
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# Outline

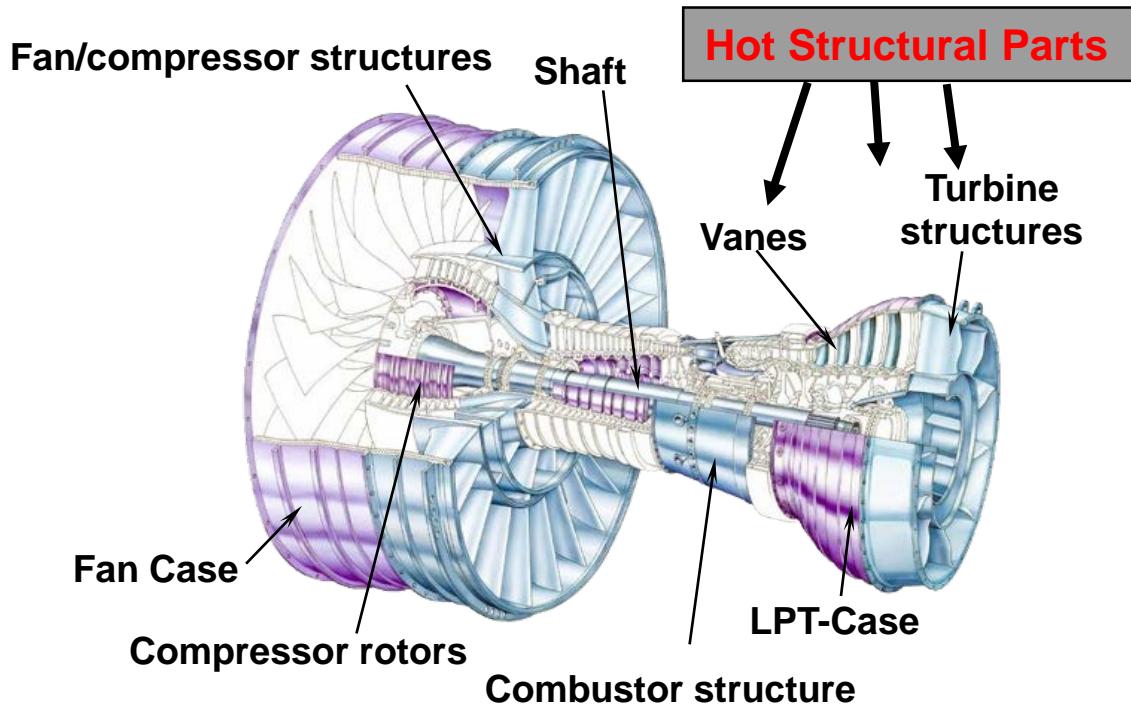
- **Introduction**
  - Hot cracking
  - Cast Alloy 718
  - Motivation
- **Experiments**
  - Varestraint
- **Results and Discussion**
- **Conclusions**

# Hot Cracking



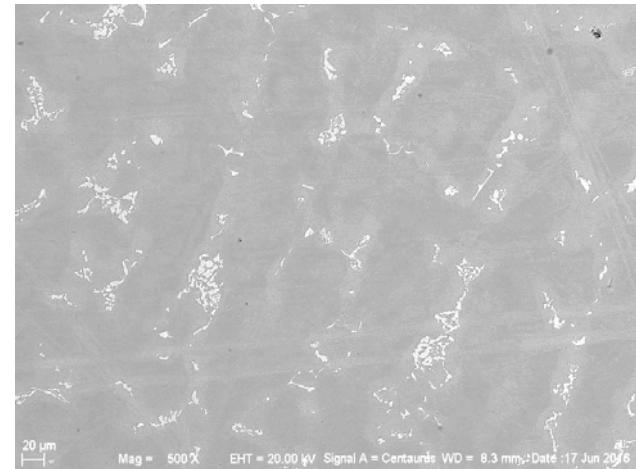
# Cast Alloy 718

Max Operating  
Temperature:  
 $650^{\circ}\text{C}$



# Cast Alloy 718

- High tendency of Nb for segregation
- Nb forms MC carbides and Laves phase



Ni	Fe	Cr	Nb	Mo	Ti	Al	...
52.98	Bal.	18.11	5.30	2.98	0.99	0.42	...

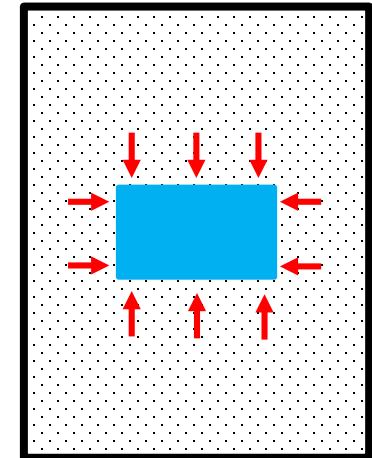
Composition in wt%

# Motivation

- **Hot Isostatic Pressing (HIP)**

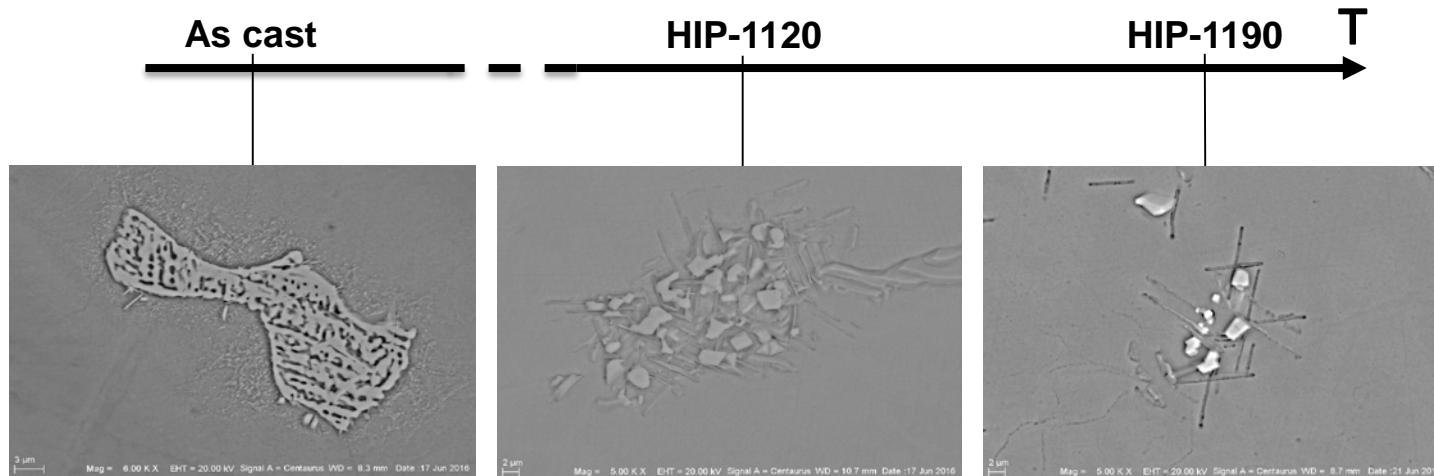
HIP

- Isostatic pressure
- High temperature
- Protected atmosphere



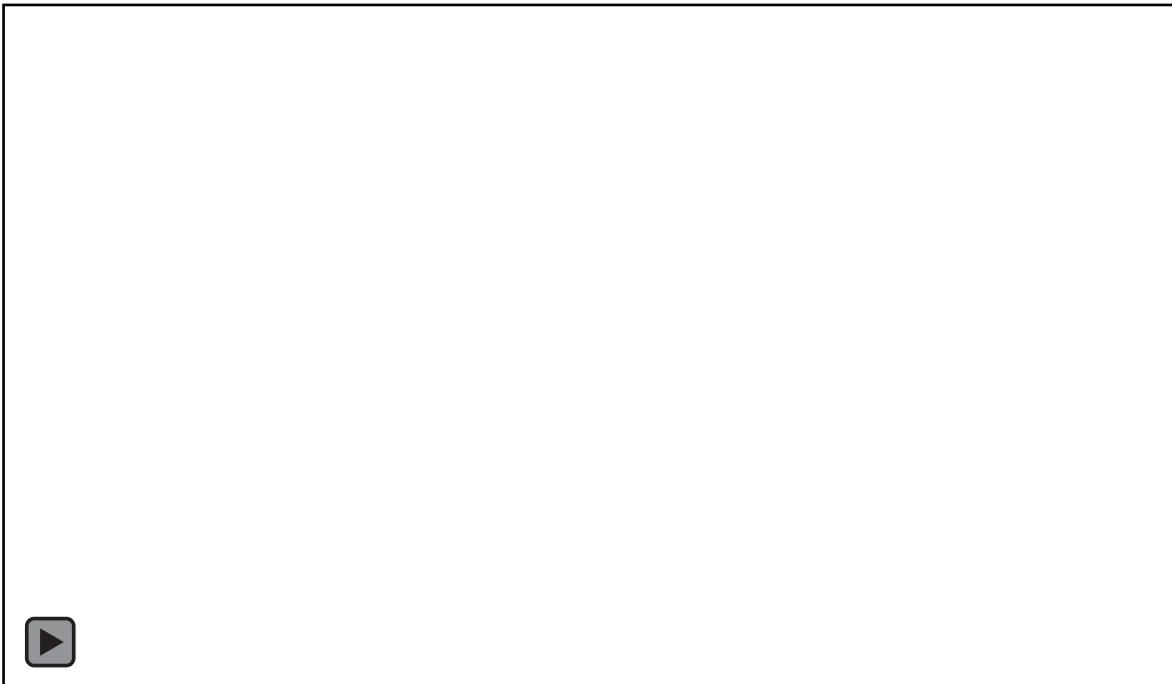
- **Two approaches:**
  - Below liquation T of Laves eutectic ( $1120^{\circ}\text{C}$ )
  - Above liquation T of Laves eutectic ( $1190^{\circ}\text{C}$ )

# Heat Treatments

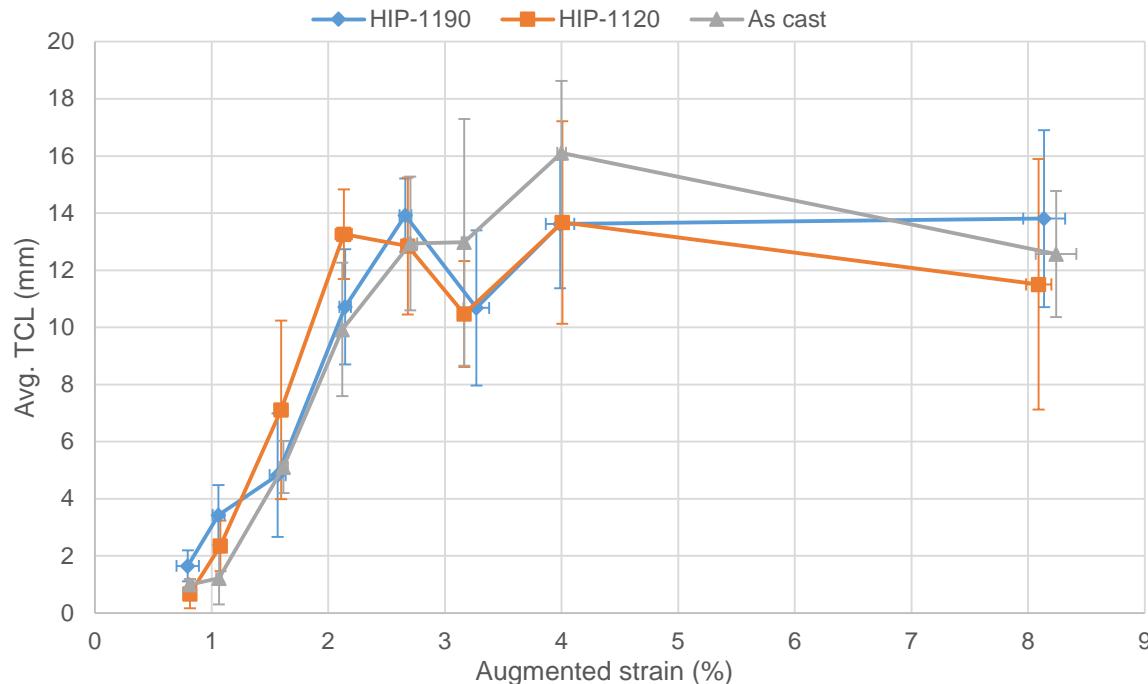


HIP at 100 MPa	Post HIP at Vacuum	Solution heat treatment
1120°C/4h	1052°C/1h + furnace cooling to 649°C in 1h	
1190°C/4h	870/10h + furnace cooling to 649°C in 1h	954°C/1h + air cooling

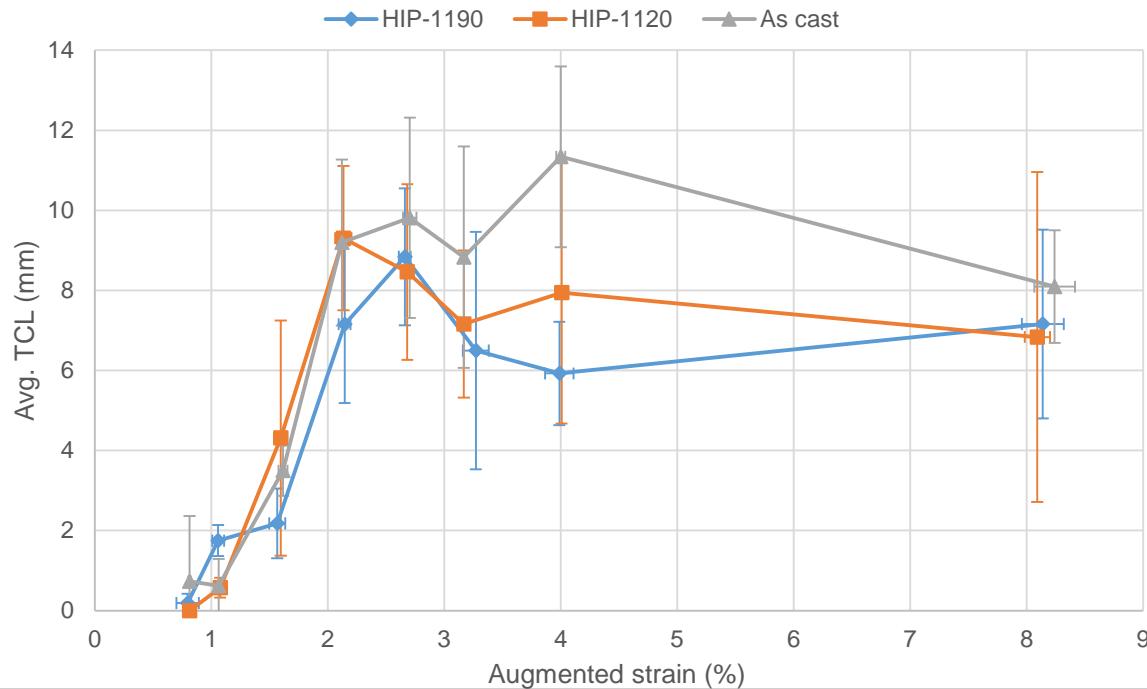
# Varestraint



# Results

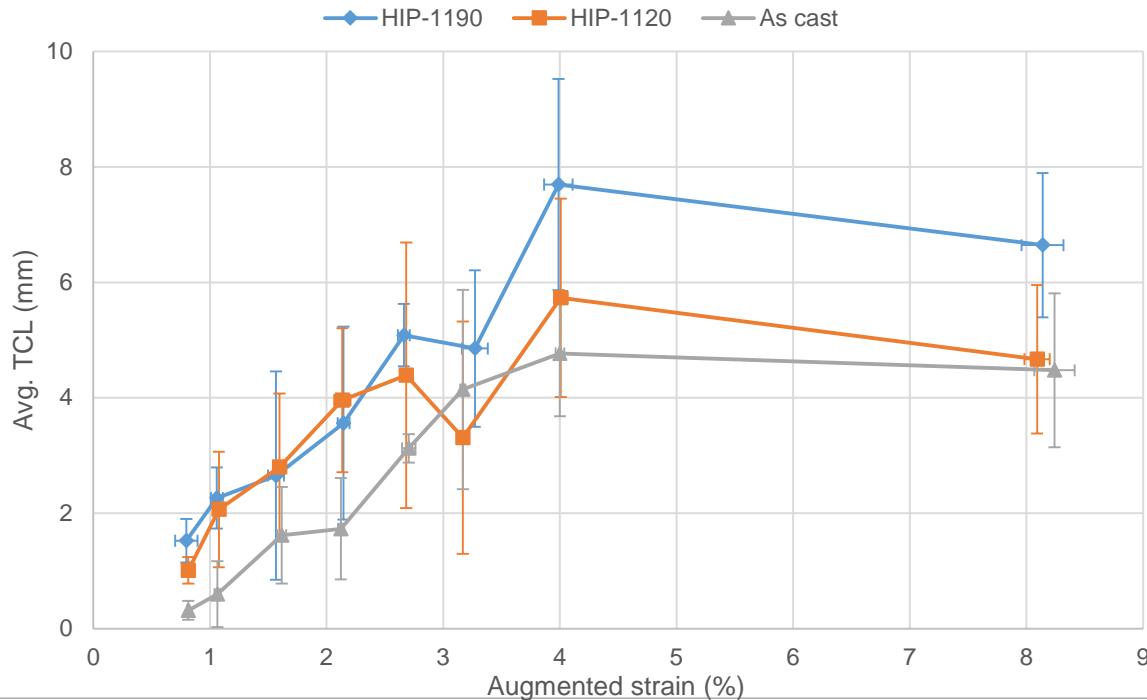


# Results for FZ



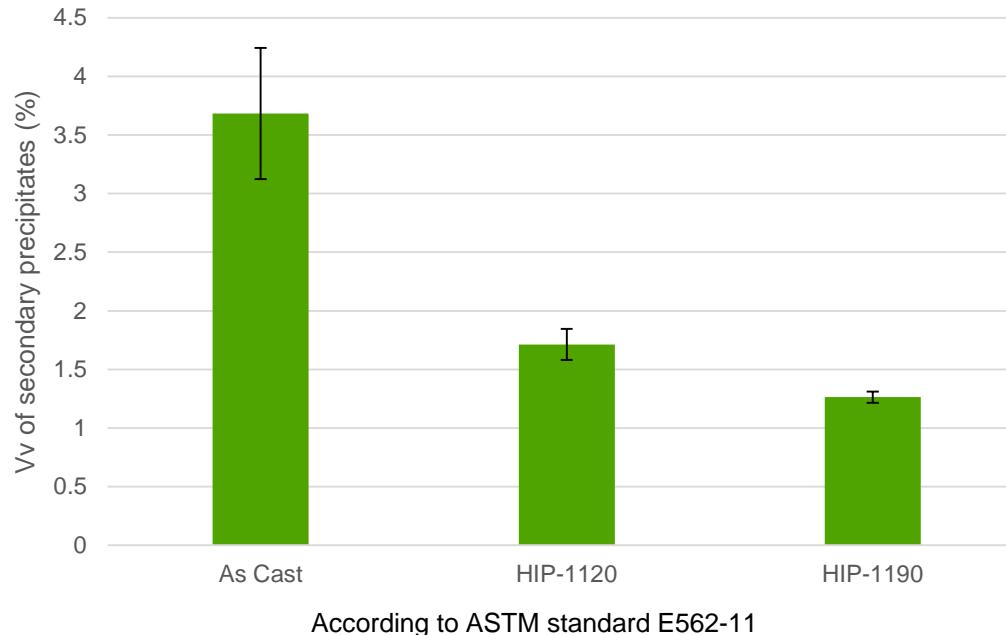
**As cast** has the **worst** susceptibility above saturation level

# Results for HAZ

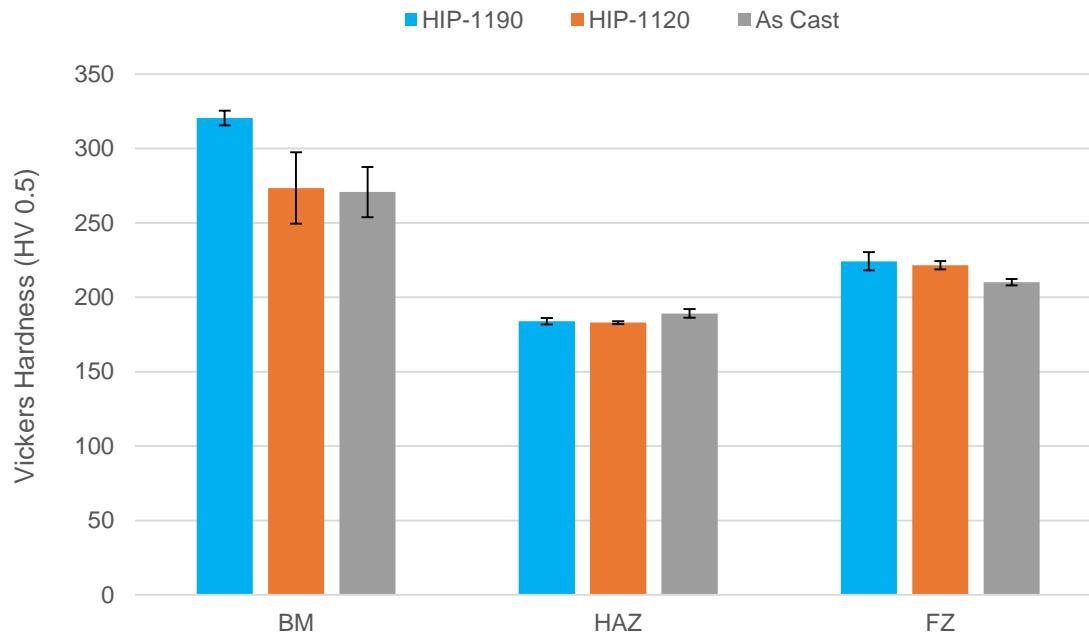


**As cast** has the **best** susceptibility

# Volume fraction



# Hardness



# Conclusions

- **Solidification Cracking**

Ranking: As cast

HIP-1190

HIP-1120

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Ongoing investigation

- **Heat Affected Zone Liquation Cracking**

Ranking: HIP-1190

HIP-1120

As cast

→ Backfilling

# Thank You!