Technology Development Needs for sCO2 Heat Exchangers

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Technical Challenges

Heat Exchangers
   Design Pressure
Technical Challenges

- Heat Exchangers
  - Design Pressure
  - Temperature Approach
Technical Challenges

Heat Exchangers
- Design Pressure
- Temperature Approach
- Material of construction

Existing materials
- 316L – 649°C
- >649°C – higher grade alloys (HR 120 – 617?)
- Corrosion behaviour?

New Materials
- Must be strong, corrosion resistant, cheap and available in many product form:
- Which one?
Technical Challenges

Heat Exchangers
  - Design Pressure
  - Temperature Approach
  - Material of construction
  - Recuperators?
Technical Challenges

**Heat Exchangers**
- Design Pressure
- Temperature Approach
- Material of construction
- Recuperators?

**Existing Technology**
- ASME ‘U’ qualified
- Proven performance in sCO2 test loops since 2003 (TIT, SNL, Echogen, GE, KAERI)
- Proven performances in many other Brayton cycles (Nitrogen, Air, Helium).
Technical Challenges

Heat Exchangers
- Design Pressure
- Temperature Approach
- Material of construction
- Recuperators?
- Coolers?
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Existing Technology
- 30 years of PCHE gas coolers
- Many units used in extremely harsh offshore environments
- Mature products
  - 2200 PCHE (<85 tons)
  - 15 FPHE (<50 tons)
- 304 / 304L / 316 / 316L / Duplex / Ti Grade 2 / 6 Moly
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- IHX?
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IHX needs development
- High temperature section (material)
- Most likely hybrid to address
  - Low pressure and pressure drop on the hot side
  - High pressure on the sCO2 side
Technical Challenges

- Test Loop overall
  - Design and components optimisation
Technical Challenges

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Technical Challenges

Test Loop overall
- Design and components optimisation
- Control (start-up, shutdown, off-design cases …)
- Influence of various material of construction on various components
Thank you

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