

Particle Heat Transfer Mechanisms (34152)

Development of a 20 kW_t Particle-to-sCO₂ Heat Exchanger

1. Impact

This project seeks to design and test a subscale particle-to-sCO₂ heat exchanger with features to improve performance (pressure drop and heat transfer) that are relevant to pilot and commercial scale versions. The test data will provide a clear understanding of the performance with model validation and path to achieving cost targets.

2. Project Goal

Acquiring data on prototype heat exchangers will lead to improved modeling capabilities used in the design process as well as identification of potential methods for improving the performance. The overall objective of this project is to supply Gen3 topic one projects with sufficient data for the design and optimization of particle-to-fluid heat exchangers.

3. Method

This project constructed an integrated test facility with electrically heated particle and sCO₂ flow

loops for evaluating heat exchanger performance at 17 MPa and 550 °C.

4. Outcome

Overall heat transfer coefficients for the prototype heat exchanger at the design point were measured up to 300 W/m²-K and cases using high approach temperature were measured with peak values as high as 400 W/m²-K.

5. Conclusion/Risks

Significant improvements in the measured performance of particle-to-sCO₂ moving packed-bed heat exchangers were observed with a path identified to achieve 150 \$/kW_t.

6. Team

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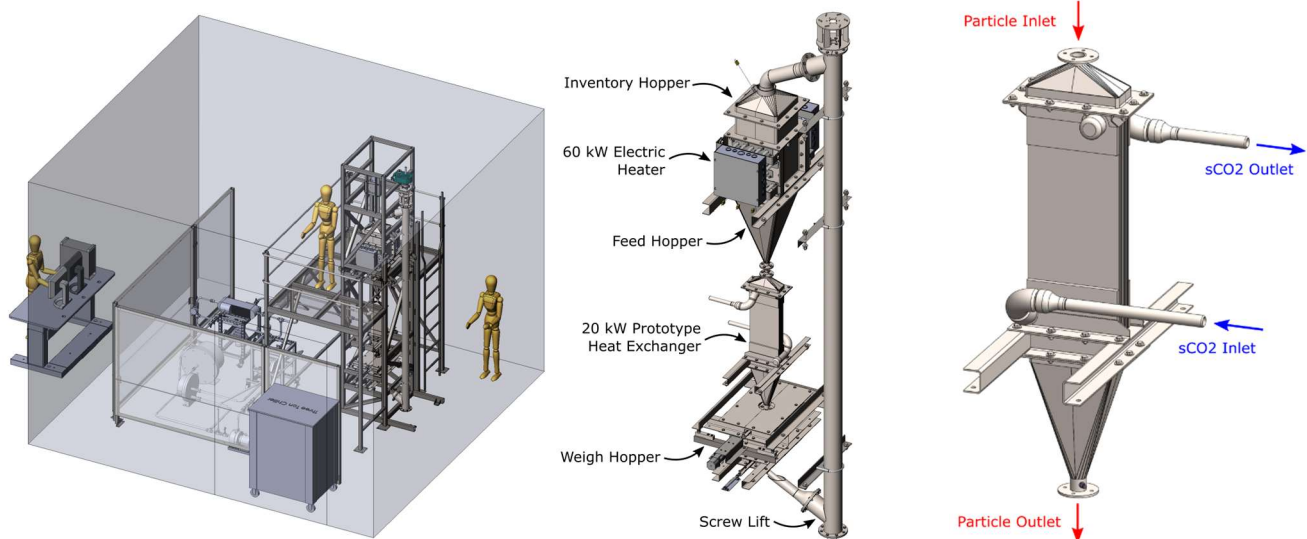


Figure 1. Illustration of the integrated particle and sCO₂ flow loops and prototype heat exchange

