High Temperature SiC Composite Receiver for CSP Operating Above 700 °C, 08995

SiC Composites enable CSP plants to operate at higher temperatures (>700°C) with higher efficiency

1. Impact
High salt exit temperatures (>720°C), increase plant thermal efficiency of >50%, reducing cost.

2. Project Goal
Develop high temperature receiver for CSP plants (2MWth) using SiC fiber composite.

3. Method(s)
- Model material properties, receiver heat transfer, and design to maximize efficiency.
- Evaluate thermal, mechanical, and optical properties.
- Prototype subscale 200 kW receiver.

4. Outcome(s)
- Designed and modeled a conceptual 2MW SiC composite CSP receiver.
- Established polymer infiltration and pyrolysis (PIP) capability. Manufactured SiC composite receiver components.
- Completed 2,500 hours of molten salt corrosion test-No Corrosion.
- Fabrication of 200 kW prototype receiver.

5. Conclusion/Risks
- Thermal shock and mechanical impact resistance SiC composite receivers can be produced via PIP with high solar optical absorptance (>0.97) and highly corrosion resistance against chloride salts.
- SiC composites can reduce cost of electricity through increased efficiency at high temperatures.
- Risk: DOE’s selection of the solid particle pathway for the Phase 3 Gen3 CSP created new challenges for liquid salt pathway.
- Risk: Demonstrate brazing of assembly.

6. Team
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Figure. Silicon carbide fiber composites receiver for high temperature Gen3 CSP plants