A High Temperature Solar Particle Receiver

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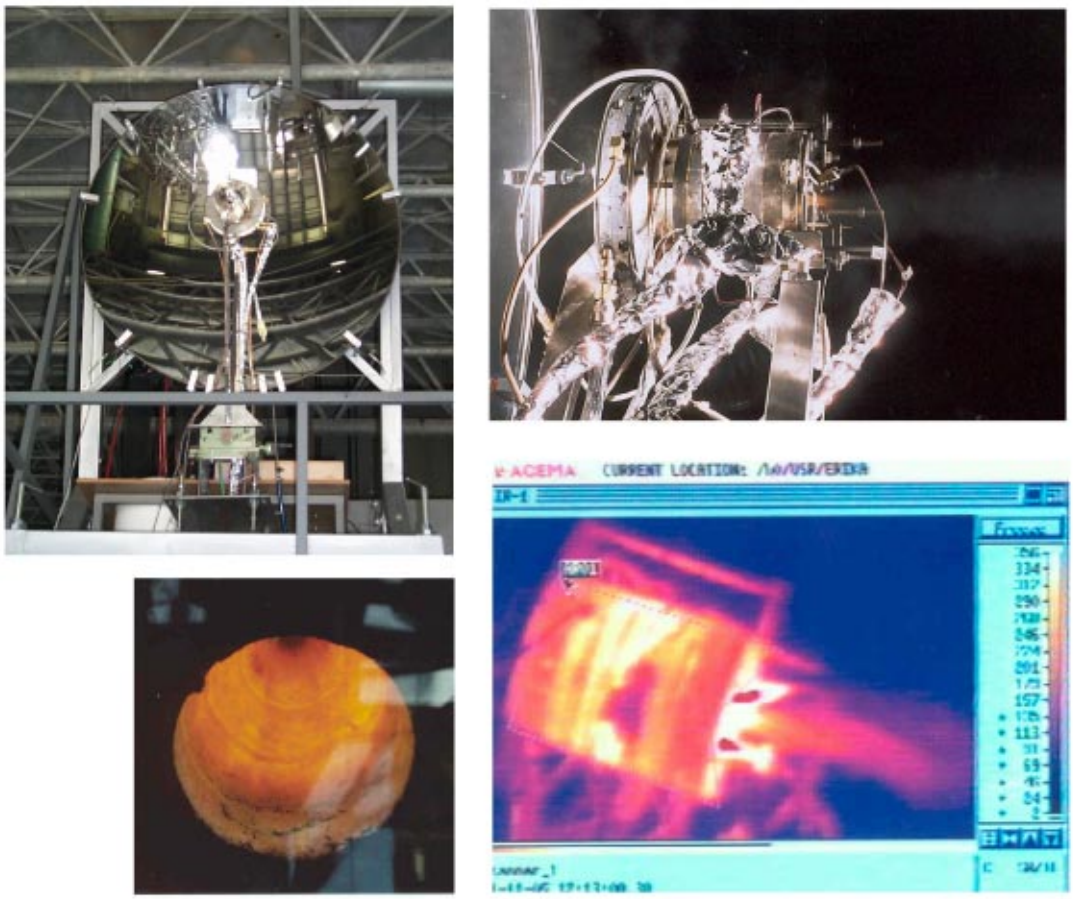
A solar particle receiver was developed to heat a process gas to very high temperatures. Its operation is based on seeding the process gas with a very large numerical amount (but small mass fraction, less than 0.5%) of sub-micron radiation absorbing particles (see article by Bertocchi et al. in this issue). The gas-particle mixture is exposed to highly concentrated solar energy in the receiver. Peak temperatures obtained were 2,100 K with Nitrogen, and 2,000 K with air. Radiation to thermal energy conversion efficiencies were estimated to exceed 85%. The receiver accumulated 12 hours of operation at temperatures over 1,700 K without major failure [1].



Top left: The test set-up, located 30 m above the heliostat field, consists of a secondary 1.5 m parabolic dish and the particle receiver. Right: The solar particle receiver in operation. The exhaust gas and particle plume is visible on the right.

Bottom Left: The hot receiver cavity, seen through the inlet aperture one minute after removing the incident radiation. The entrance region is relatively cold, and the hottest location is about two thirds of the way towards the back of the cavity. Right: IR image of the exterior of the particle receiver during operation, with the hot exhaust gas and particle plume exiting to the right.

References

[1] Bertocchi R., Karni J., and Kribus A., 2004, ''Experimental evaluation of a high temperature solar particle receiver,'' Energy **29**, pp. 687–700.

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