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Fundamental study of a loop-tube-type thermoacoustic cooling system using heat energy from condensed sunlight

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The feasibility of implementation of a sunlight-based loop-tube-type thermoacoustic cooling system is investigated. Sunlight is condensed using a 0.60 m diameter Fresnel lens and irradiated to the high-temperature heat exchanger. Then, the temperature of heat exchanger is risen. This heat energy from condensed sunlight is applied to the driving hear energy of the loop-tube-type thermoacoustic cooling system. The total length of the loop tube is 3300 mm, and a gaseous mixture of He and Ar (50% / 50%) is used as the working fluid. A 50-mm-long ceramic honeycomb is used for the stack. The channel radius of the prime mover stack is 0.45 mm; that of the heat pump is 0.35 mm. The cooling point temperature falls from 29°C to -4.3°C before sunlight is irradiated to the high-temperature heat exchanger. Consequently, a temperature drop of 33.3°C is achieved using sunlight. Result obtained in this experiment underscores the feasibility of implementation of a sunlight-based loop-tube-type thermoacoustic cooling system.