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Using helium as the working fluid to improve efficiency of high-frequency thermoacoustic engines[1] NATHANIEL WELLS, BRIAN PATCHETT, BONNIE ANDERSEN, Utah Valley University — Previous work on thermoacoustic engines with bottle-shaped resonators has been done to improve performance by varying geometric parameters using air as the working fluid. This study is focused on transitioning from air to helium for the working fluid to further improve device performance. The theoretical ratio of efficiencies was derived for the two operating fluids. The existing engine was redesigned for evacuating the air and introducing helium into the resonator and six different types of heat shrink tubing used to hold the heat exchangers in place were tested for effectiveness with a vacuum and ease of removal. The optimal stack masses for this engine operating with air and helium were theoretically estimated and tested with air using six different stack masses from 50 to 62 mg. The resonator had a cavity with a length of 10 cm and ID of 4.13 cm and a neck with a length of 2.62 cm and ID of 1.91 cm and used steel wool for the stack material. The engine was supplied 12 W from a heating element applied above the hot heat exchanger in the neck and the acoustic pressure at the bottom of the cavity was measured. The optimal amount of stack in air was found to be 56mg and the acoustic pressure was 206 Pa, Pk-Pk. The adhesive heat shrink tubing was found to be the most effective for use with helium and ease of removal.

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