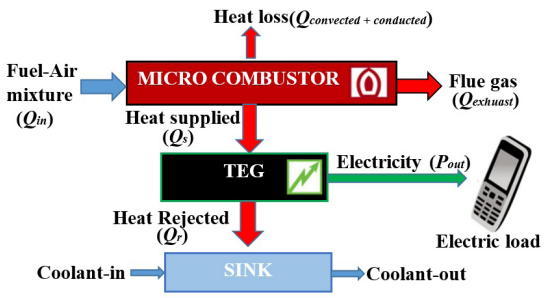
Development of small scale stand alone thermoelectric power generation systems using microcombustors

Combustion driven power sources offer astounding advantages over conventional chemical batteries, such as higher energy densities, lower weight, short recharging time, limitless number of rechargeable cycles and environment friendly operation. These devices have wide applications in micro satellite thrusters, MEMS, chemical sensing, and micro air vehicles (MAV). Our research aims at developing a combustion based portable power device using thermoelectric generators (TEG) which can provide flexibility of increasing and decreasing the power output. This would also help in easy maintenance and reduced cost in comparison to the existing systems. Chemical batteries, being at the peak of their evolution, are still unable to meet the high-power density requirements pertaining to the military (MCCS), survillienace and numerous other similar applications.

Our group has been working on the combustion driven portable power generation systems for the past six years. We are essentially focusing on the micropower generation systems, which can be used as alternative power source for the portable electronic devices, such as notebook computers, mobile phones, video camera, etc.



Schematic diagram of the working principle of typical thermoelectric power generation systems

Working principles are thoroughly explored by this time and we are successful in harvesting a power of ~4W from a system with a comparatively higher conversion efficiency of 4.03% which is one of the highest in the existing devices with a power density of 0.12 mW/mm^3. The system compactness and the output power with high conversion efficiency shows the possibility of its application in various portable scale power generators for remote, stand-alone, military and aerospace applications. The power density (mW/mm^3) of this novel concept based micropower generator is ~50% higher than the existing similar stand-alone micropower generation systems.

Size comparison of the developed system with the conventional electro chemical battery

Further, it would be possible to scale up this existing system to produce power as high as 300W and more, by modifying the heating source and introducing high efficient thermo electric modules. However, the proposed system may take few minutes to start delivering the desired electrical output, as it is a combustion based system.

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