Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 3, March : 2023

RENEWABLE USE OF WASTE HEAT AND CURRENT USING THERMO ELECTRIC GENERATOR AND NANO MOSFET USING VLSI AND GSI TECHNOLOGY

Rudra Prasad Nanda Department of Electrononics and Communication Engineering, Department of Computer Science Engineering, Aryan Institute of Engineering and Technology, Bhubaneswar
Amiya Kumar Sahoo, Prakash Kumar Dehury AIET , Bhubaneswar
rudrananda102@gmail.com, rudra@aryan.ac.in, dehuryprakashkumar1982@gmail.com

Abstract
This research explores a new method of recovering waste heat and electricity using a combination of heat pipes and thermoelectric generators (HP-TEG). The HP-TEG system consists of Bismuth Telluride (Bi2Te3) based thermoelectric generators (TEGs), which are sandwiched between two finned heat pipes to achieve a temperature gradient across the TEG for thermoelectricity generation. A theoretical model was developed to predict the waste heat recovery and electricity conversion performances of the HP-TEG system under different parametric conditions. The modeling results show that the HP-TEG system has the capability of recovering 1.345 kW of waste heat and generating 10.39 W of electrical power using 8 installed TEGs. An experimental test bench for the HP-TEG system is under development and will these Thermal management and energy crisis have been two major problems in this 21st century. Engine exhaust has tremendous amount of energy which can be recovered by waste heat recovery systems and it can be converted in to useful energy such as electric power. The thermoelectric concept is seen as a perfect solution for recovering waste heat from engine exhaust and converts in to electric energy. Since the use of nano thermoelectric materials for thermoelectric applications, there has been a huge quest for improving its figure of merits (ZT) to make it commercially viable. This review starts with thermoelectric concepts and explains briefly properties of thermoelectric materials, preparation of thermoelectric materials, modeling and simulation, experimental investigation and parametric evaluation. The present study focuses on various operating condition i.e. flow rate, temperatures of fluids, heat transfer coefficient of exhaust gas or hot fluid and position of thermoelectric module. The configurations (topology or geometry) of thermoelectric generator play a vital role for increasing effectiveness of the heat recovery system and conversion efficiency of thermoelectric generator. Conducting polymer composites (CPC) were prepared with an ethylene–octene copolymer (EOC) matrix and with either carbon fibers (CFs) or multiwall carbon nanotubes (MWCNTs) as fillers. Their electrical and thermal conductivities, mechanical properties and thermal stabilities were evaluated and compared. CF/EOC composites showed percolation behavior at a lower filler level (5 wt.%) than the MWCNT/EOC composites (10 wt.%) did. Alternating current (AC) conductivity and real part of permittivity (dielectric constant) of these composites were found to be frequency-dependent. Dimensions and electrical conductivities of individual fillers have a great influence on the conductivities of the composites. CF/EOC composites possessed higher conductivity than the MWCNT-composites at all concentrations, due to the higher length and diameter of the CF filler. Both electrical and thermal conductivities were observed to increase with increasing filler level. Tensile module and thermal stabilities of both (CF/EOC and MWCNT/EOC) composites increase with rising filler content. Improvements in conductivities and mechanical properties were achieved without any significant increase in the hardness of the composites; therefore, they can be potentially used in pressure/strain sensors. Thermoelectric behavior of the composites was also studied. Accordingly, CF and MWCNT fillers are versatile and playing also other roles in their composites than just being conducting fillers.

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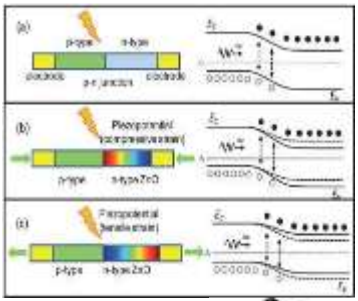
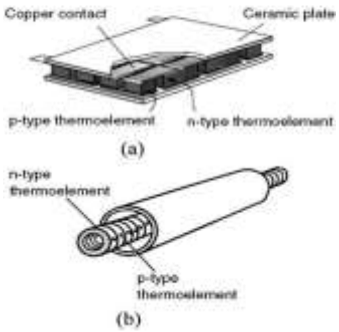
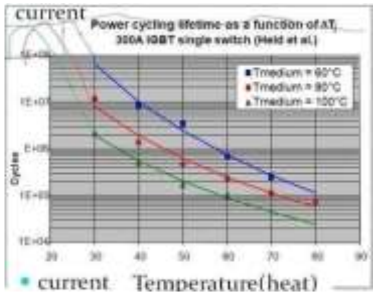
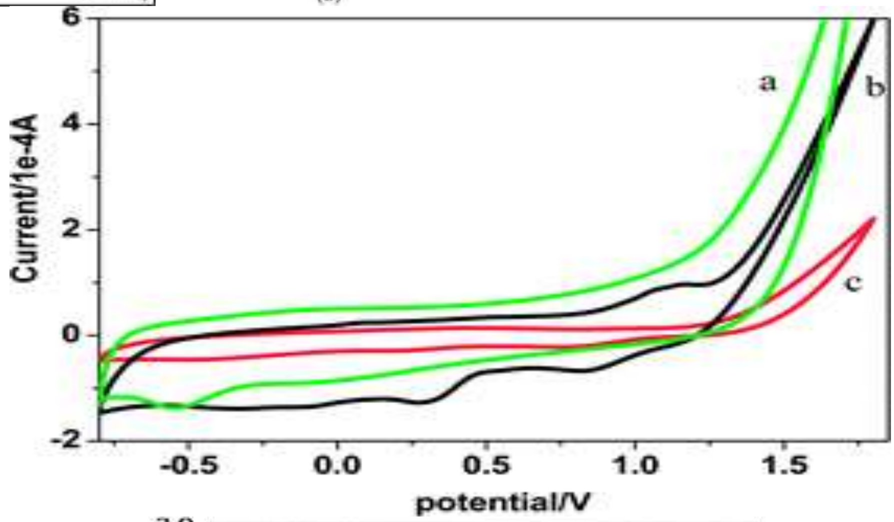
Introduction

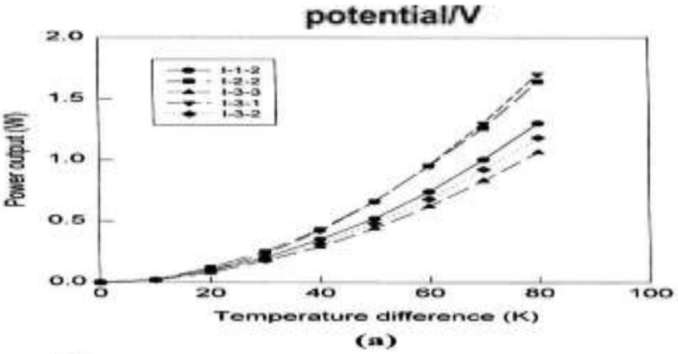
There are few materials which traditionally have been used as thermoelectrics. Important representatives are telluride based alloys. Tellurium is one of the rarest elements on earth. Its price is much higher than that of gold, and the prognosis is a steady rise in price. It is therefore necessary to develop thermoelectric materials using a raw material which is abundant and environmentally unobjectionable. . Several research projects of our group deal with this question: A thermoelectric power generator is a solid state device that provides direct energy conversion from thermal energy (heat) due to a temperature gradient into electrical energy based on "Seebeck effect". The thermoelectric power cycle, with charge carriers (electrons) serving as the working fluid,follows the fundamental laws of thermodynamics and intimately resembles the power cycle of conventional heat engine. Thermoelectric power generators offer severaldistinct advantages over other technologies they are extremely reliable (typically exceed 100,000 hours of steady-state operation) and silent in operation since they have no mechanical moving parts & require considerably less maintenance; they have very small size and virtually weightless; they are capable of operating at elevated temperatures ; they are suited for small-scale and remote applications typical of rural power supply, where there is limited or no electricity; they are environmentally friendly; -dependent; and they are flexible power sources. The major drawback of thermoelectric power generator is their relatively low conversion efficiency (typically ~5% .This has been a major cause in restricting their use in electrical power generation to specialized fields with extensive applications where reliability is a major conderation and cost is not. Applications over the past decade included industrial instruments, military, medical and aerospace , and applications for portable or remote power generation . However, in recent years, an increasing concern of environmental issues of emissions, in particular global warming has resulted in extensive research into nonconventional technologies of generating electrical power and thermoelectric power generation has emerged as a promising alternative green technology. Vast quantities of waste heat are discharged into the earth's environment much of it at 3 | P a g e temperatures which are too low to recover using conventional electrical power generators. Thermoelectric power generation (also known as thermoelectricity) offers a promising technology in the direct conversion of low-grade thermal energy, such as waste-heat energy, into electrical power . Probably the earliest application is the utilization of waste heat from a kerosene lamp to provide thermoelectric power to power a wireless set. Thermoelectric generators have also been used to provide small amounts electrical power to remote regions for example Northern Sweden, as an alternative to costly gasoline powered motor generators .In this waste heat powered thermoelectric technology, it is unnecessary to consider the cost of the thermal energy input, and consequently thermoelectric power generators' low conversion efficiency is not a critical drawback . In fact, more recently, they can be used in many cases, such as those used in cogeneration systems , to improve overall efficiencies of energy conversion systems by converting waste-heat energy into electrical power . In general, the cost of a thermoelectric power generator essentially consists of the device cost and operating cost. The operating cost is governed d by the generator's conversion efficiency, while the device cost is determined by the cost of its construction to produce the desired electrical power output . Since the conversion efficiency of a module is comparatively low, thermoelectric generation using waste heat energy is an ideal application. In this case, the operating cost is negligible compared to the module cost because the energy input (fuel) cost is cheap or free. Therefore, an important objective in thermoelectric power generation using waste heat energy is to reduce the cost-perwatt of the devices. Moreover, cost-per-watt can be reduced by optimising the device geometry, improving the manufacture quality and simply by operating the device at a larger temperature difference . In addition, in designing highperformance thermoelectric power generators, the improvement of thermoelectric properties of materials and system optimization have attracted the attention of many research activities . Their performance and economic competiveness appear to depend on successful development of more advanced thermoelectric materials and thermoelectric power module designs. In this paper, a background on the basic concepts of the thermoelectric power generation is presented through the applications implemented in the recent patents of thermoelectric power generation relevant to waste-heat energy.

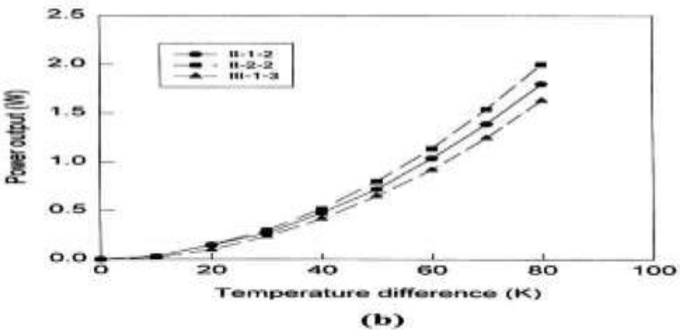
Methodology and Result Analysis









Conclusion and Future work

Thermoelectric generators can be applied in a variety of applications. Frequently, thermoelectric generators are used for low power remote applications or where bulkier but more efficient heat engines such as Stirling engines would not be possible. Unlike heat engines, the solid state electrical

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components typically used to perform thermal to electric energy conversion have no moving parts. The thermal to electric energy conversion can be performed using components that require no maintenance, have inherently high reliability, and can be used to construct generators with long service free lifetimes. This makes thermoelectric generators well suited for equipment with low to modest power needs in remote uninhabited or inaccessible locations such as mountaintops, the vacuum of space, or the deep ocean.
Common application is the use of thermoelectric generators on gas pipelines. For example, for cathodic protection, radio communication, and other telemetry. On gas pipelines for power consumption of up to5 kW thermal generators are preferable to other power sources. The manufacturers of generators for gas pipelines are Global Thermoelectric (Calgary, Canada) and TELGEN (Russia).Thermoelectric Generators are primarily used as remote and off-grid power generators for unmannedsites. They are the most reliable power generator in such situations as they do not have moving parts (thusvirtually maintenance free), work day and night, perform under all weather conditions, and can work without battery backup. Although Solar Photovoltaic systems are also implemented in remote sites, Solar PV may not be a suitable solution where solar radiation is low, i.e. areas at higher latitudes with snow or no sunshine, areas with lots of cloud or tree canopy cover, dusty deserts, forests, etc.Global Thermoelectric (Canada) has Hybrid Solar-TEG solutions where the Thermolectric Generator backs up the Solar-PV, such that if the Solar panel is down and the backup battery backup goes into deep discharge then a sensor starts the TEG as a backup power source until the Solar is up again. The TEG heatcan be produced by a low pressure flame fueled by Propane or Natural Gas.Many space probes, including the Mars *Curiosity* rover, generate electricity using a radioisotope thermoelectric generator whose heat source is a radioactive element.

Cars and other automobiles produce waste heat (in the exhaust and in the cooling agents). Harvesting that heat energy, using a thermoelectric generator, can increase the fuel efficiency of the car. For more details,see the article: Automotive Thermoelectric Generators.

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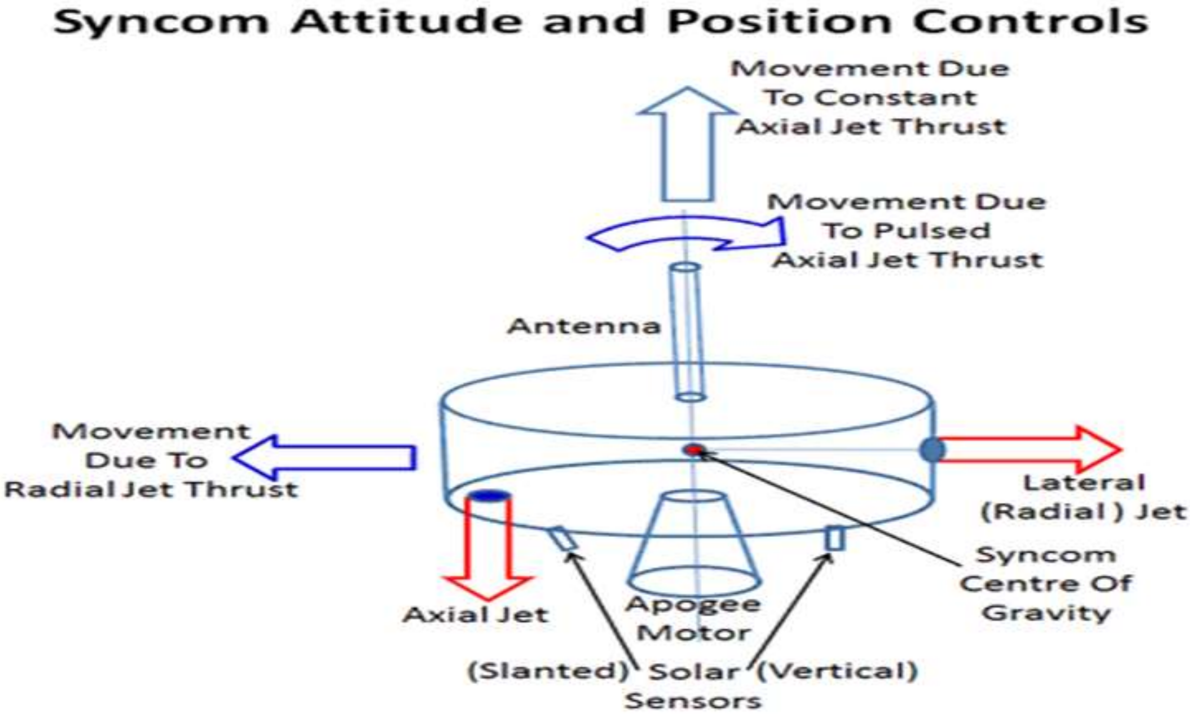

In addition to automobiles, waste heat is also generated in many other places, such as in industrial processes and in heating (wood stoves, outdoor boilers, cooking, oil and gas fields, pipelines, and remote communication towers). Again, the waste heat can be reused to generate electricity. In fact, several companies have begun projects in installing large quantities of these thermoelectric devices. Somecompanies include TEGPRO , Thermal Electronics Corp., Custom Thermoelectric , Marlow Industries, tecteg MFR., wellentech and Tegpower . Other companies are developing consumer-level applications to capture the energy commonly wasted during cooking. A handful of USB cooking products have emerged, such as the BioLite stoves, Hatsuden Nabe thermoelectric cookpot Stove Lite - Light up your room with your Wood Stove Stealth Power Systems, and the PowerPot. Wood stove TEG12VDC-24AIR and TEG12VDC-24LIQUID TEG Generators producing enough power to trickle charge 12VDC and 24VDCbatteries. Thermal Electronics Corp. Devil Watt Wood stove Thermoelectric Generators produce as much as 50 Watts of Power. Devil Watt Tegulator Thermoelectric Generator EnergyHarvesting Modules convert very low voltage into regulated outputs of 1.8, 2.2, 3.0, 3.3 and 5.0 volts.Microprocessors generate waste heat. Researchers have considered whether some of that energy could be recycled. (However, see below for problems that can arise.)Solar cells use only the high frequency part of the radiation, while the low frequency heat energy is wasted. Several patents about the use of thermoelectric devices in tandem with solar cells have been filed.The idea is to increase the efficiency of the combined solar/thermoelectric system to convert the solar radiation into useful electricity.The Maritime Applied Physics Corporation in Baltimore, Maryland is developing a thermoelectric generator to produce electric power on the deep-ocean offshore seabed using the temperature difference between cold seawater and hot fluids released by hydrothermal vents, hot seeps, or from drilled geothermal wells. A high reliability source of seafloor electric power is needed for ocean observatories and sensors used in the geological, environmental, and ocean sciences, by seafloor minerals.

FUTURE WORK

All vehicles are moving from one place to other using charge.Only fuel is electrons flow.
Using environmental charge we are moving in our on vehicle.
Vehicles are frictionless and use electro magetic force as well as electro motive force.Charging and

discharging using ptype and n type and g type.
P=p+, n=n- ,g=g+- .

Noise has been the subject of a proposal by NiPS Laboratory in Italy to harvest wide spectrum low scale vibrations via a nonlinear dynamical mechanism that can improve harvester efficiency up to a factor 4 compared to traditional linear harvesters.

An athlete can produce about 300 to 400 watts of mechanical power for an hour or so (1/3 kWh/1/2 hp), but adults of good average fitness average between 50 and 150 watts for an hour ofvigorous exercise (1/10 kWh). A healthy laborer may sustain an average output of about 75 wattsfor some eight hours (½ Kwh). Pedal power is therefore most suitable for fairly short tasks with modest power demand.

Biomechanical energy harvesters are also being created. One current model is the biomechanical energy harvester of Max Donelan which straps around the knee. Devices as this allow the generation of 2.5 watts of power per knee. This is enough to power some 5 cell phones. The Soccket can generate and store 6 watts. There is also a knee brace developed by Bionic Power which is based in Canada.

Body-energy can also be extracted as described for wristwatches (See 'devices' above), fromblood for pacemakers.

The AMTEC cycle of heating the Sodium vapour to increase its pressure, followed by its expansion and pressure drop through the solid electrolyte, and subsequent cooling can be considered as a heat engine, The maximum theoretical (ideal) energy conversion efficiency, or Carnot efficiency of the cycle is given by **$(1-T_c/T_h)*100\%$** where **T_h** is the temperature at the hot side of the device and **T_c** is the temperature at the cold side of the device. In the example above, the Carnot efficiency is (1-700/1000)*100 which is 30% although 40% is theoretically possible with a higher operating temperature.

In practice however the highest conversion efficiencies which have been achieved with AMTEC devices are just over 20% and this compares very favourably with alternative direct energy conversion devices such as semiconductor thermocouple arrays (TEGs) which typically have efficiencies of 5% to 7%. This is particularly important in batteries such as Radioisotope Thermoelectric Generators (RTGs) used in spacecraft applications since the mass of the radioactive heat source required by the AMTEC device to produce agiven amount of electrical energy will be only one quarter of the mass needed by an equivalent thermocouple energy converter. This translates into huge savings in system mass, fuel load and cost.

Because the AMTEC device has no moving parts and uses a closed heat cycle its overall conversion efficiency also compares favorably with conventional steam turbine.

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