Journal of Science and Technology
ISSN: 2456-5660 Volume 6, Issue 04 (Jul-Aug 2021)

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp244-250*

Experimental Study of Earth Batteries

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To Cite this Article

Mr.V.N.V.Radha Krishna Murty , Dr.A.Padmanabham , Mr.Kiran Bachina*,“ *Experimental Study of Earth Batteries*”, *Journal of Science and Technology, Vol. 06, Issue 04, July-Aug 2021.

Article Info
Received: 01-04-2021 *Revised: 09-04-2022* *Accepted:15-06-2022* *Published: 04-08-2022*

Abstract
Earth batteries have been successfully built and operated as an alternative source of low-power electric supply. Different electrode configurations were tested for the greatest possible variation in potential. The most appropriate combinations of frequently accessible metals were chosen for more thorough characteristic investigations in light of robust and cost-effective application of this natural power technology by untrained village customers. Each cell produced a voltage of 2.05, 1.40, 1.10, and 0.9 volts when the anode and cathode were made of Magnesium, Zinc, Aluminum, and Carbon, respectively. One Zn-Cu cell was found to have an average rated power of a few tens of microampere. When it came to low-power electronic products like mobile phones and white-light LED calculators and wristwatches, the site had them all. Using many earth battery cells in series like a commercial lead acid battery resulted in a linear rise in the voltage. The load current was found to rise by connecting earth cells in parallel. Furthermore, increasing the electrode surface area was shown to boost source current capacity. However, single cell voltage was shown to stay consistent independent of the electrode diameters. According to this research, the most cost-effective metal electrodes for earth batteries have been studied. Operation of earth batteries as a free power source was proved effectively.

INTRODUCTION
Reported free energy holy grails may include electrostatic motors, geo-magnetic generators [1-2], air [3], sea [4] and earth batteries [5-8]. Some free energy proponents have frequently been concentrating on the perpetual motion machines employing scientifically unfeasible theories such as over unity devices, millennium motors, resonance based self-charging and free wheeling devices. There exists nothing as free energy source such as mutual powering motor-generator set without any net input or gravity based free running machines or negative resistance based amplification. However, earth soil chemical processes and electron affinity based earth batteries may be researched for low to high voltage DC potential to drive small scale white emission LED lighting loads in remote mountainous places or small scale electronic equipment. They may also be considered to replace high voltage low current charging power sources or ionisation power supplies. Like earth batteries the marine batteries likewise may be explored for comparable uses. However, air batteries may be employed for bulk power generation and grid system operation [3]. In light of global energy crisis to be triggered by natural end of oil and gas during next 50 to 60 years time [9-11], it has become extremely vital to seek for alternative energy sources to hold back the human race from involvement to a major energy war [12-13] Although, uranium [14] and coal [9] would continue to exist for few millennia but they can not replace oil and gas despite dangers of radiation hazards (plutonium) and greenhouse gases (CO2) (CO2). Either, we can halt global warming at danger of nuclear radiation or make the earth nuclear free at risk of global warming owing to increasing temperatures from1.4 to 5.8ºC from 1990 to 2100 by exponentially rising CO2 concentrations. Rise in earth surface temperature in last 10 hot years (1997-2007) was roughly 0.6ºC. Maximum temperature has been reported to

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp244-250*

be 52ºC in major cities of Pakistan and 46ºC in Greece. Cool the house and heat the world or adapt to natural ways of existence. We must halt usage of excessive energy for amusement and retune ourselves to new lifestyles demanding least amount of energy in the form of cooling or heating. The scientists must work hard to investigate new sources of energy otherwise be prepared to be died soon in a major energy war or global greenhouse impact none knows which triumphs sooner. This study is a very honest attempt to examine the possibilities of utilising earth batteries for distant village lights, communication signalling and running small scale electronic loads when there is no other source of power or easy to preserve electricity. Assuming uniform electrode profile the potentials of various typical metals electrode pairs in soils are presented in Table 1. [15-17].

Table 1 Potential of Common Metals Suitable for Earth Battery

Anode materials		Cathode materials		Battery
Material	E^o(V)	Material	E^o(V)	Volts
magnesium	-1.75	coke	+0.30	2.05
zinc	-1.10	graphite	+0.30	1.40
zinc	-1.10	copper	+0.20	0.90
aluminium	-0.80	carbon	+0.30	1.10
iron	-0.50	coal	+0.30	0.80

A few large-sized C, Mg, and Al electrodes are being built or tested to see whether greater currents and voltages are possible. Earth batteries, in contrast to automotive air batteries, have very low Wh capacity. It is unable to run even the most basic motorised toys for children. Due to a lack of voltage, the above-ground battery was unable to power even a 0.7mA LED. It averaged 0.63 watts of output power. Except for an electronic digital clock, it was still too tiny to operate any motorised load. These two materials are all that is needed to make a basic air battery (or iron). Aluminum reacts with oxygen from the air that seeps through saltwater-soaked paper. Aluminum and carbon electrodes may be able to generate enough usable voltage. The voltage of an air battery cell is affected by the reduction potential of the battery. As a rule of thumb,

Table 2 Standard Reduction Potentials of Elements at 25ºC

Anode materials		Cathode materials		Battery
Material	E^o(V)	Materials	E^o(V)	Volts
$Li^+(aq)$	**-3.045**	**$F_2(g)$**	**+2.870**	**5.915**
$Na^+(aq)$	-2.710	$H_2O_2(aq)$	+1.780	4.490
$Mg^{2+}(aq)$	-2.370	$MnO_4^-(aq)$	1.510	3.880
$K^+(aq)$	**-2.925**	**Au(aq)**	**+1.500**	**3.425**
$Al^{3+}(aq)$	-1.660	$Cl_2(g)$	1.360	3.020
$Zn^{2+}(aq)$	**-0.760**	**$Cu^{2+}(aq)$**	**0.340**	**1.100**

Air batteries' per cell voltage ranges are much lower than those of air batteries. While the best Li+ (aq)-F2(g) air battery has 5.915 volts, Mg-C has a maximum of 2.05 volts. Nevertheless, for commercial application, air battery design must take into account a number of other economic factors. In compared to a 22kWh NiCd battery, a typical Zn Air battery can provide 312kWh of power. Using bigger capacity batteries, they are capable of supplying 200HP of traction drive at 20mph or 35mph. The recent tendency is to increase the speed to 55mph in order to save energy. Several nations have been using this technology for a long period of time. 200-250Wh/kg and 300-375Wh/L are the air battery energy to weight and energy to size ratios.

EXPERIMENTAL SETUP

The precise voltage and currents of an earth battery cell made up of zinc and copper electrodes were measured in an experiment. Simple pricking of pointed electrodes on the Earth's surface is used to place electrodes on the planet's

surface in an open air setting. Small-scale lighting and electrical loads may be powered by the electrode soil reaction voltage of 0.92V. At smaller distances between the cathode and anode, currents and voltages were greater, whereas at wider distances they were lower. The voltage and current measurements on the digital multimeter were found to be unreliable. When the electrodes were swapped from north to south, the voltages and currents rose significantly. For several electrodes, the average voltage and current magnitudes were 0.910.15V and 0.70.25mA. Electrode materials and their typical reduction potentials determine the Earth battery's potential. An increase in earth battery voltage is possible by selecting materials with greater positive and negative reduction values. Zn-Cu earth battery voltage is theoretically 0.92V, however our readings with the UNI T professional digital VOAM # 1050444792 (Korea) were roughly 0.900.25V. Efficient electrodes are needed to build a high voltage battery. Common metals behave similarly, with the exception of the fact that the amplitude of the current is dependent on the electrode surface area. Figure 1 depicts the fluctuation of the observed voltages and currents.

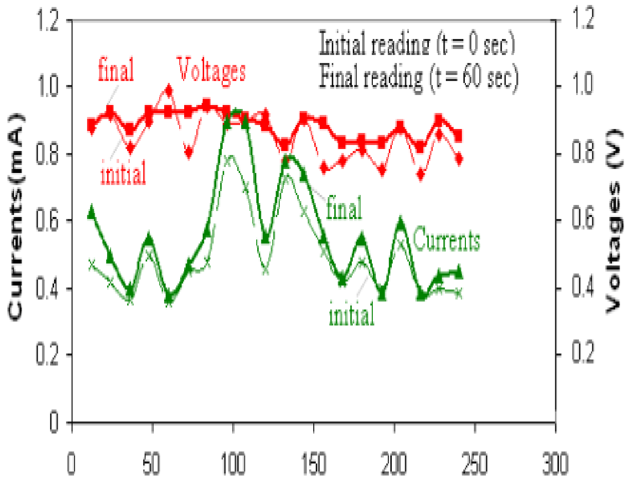
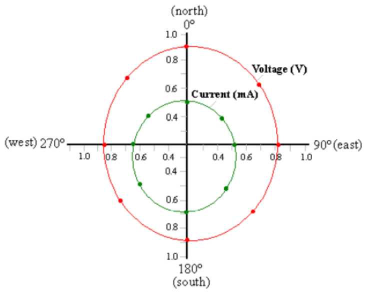


Fig.1 Copper (south)-Zinc (north) earth battery voltages and currents

After repeating the experiment using insulated box mud cells, the voltage and current were found to be very steady. In addition to the typical earth battery currents, it was hypothesised that measurements taken on bare ground would have additional telluric earthcurrents attached to them. For the purpose of determining whether or not telluric earth currents influence the natural direction of measured currents and voltages, the zinc electrode was fixed in the ground and the copper electrode was rotated for multiple directions between 0o (north), 90o (east) and 180o (south) and 270o (north) (west). As shown in Fig. 2, the voltage and current magnitudes at a fixed radius of 9 feet circle were observed



to slightly fluctuate in magnitudes.

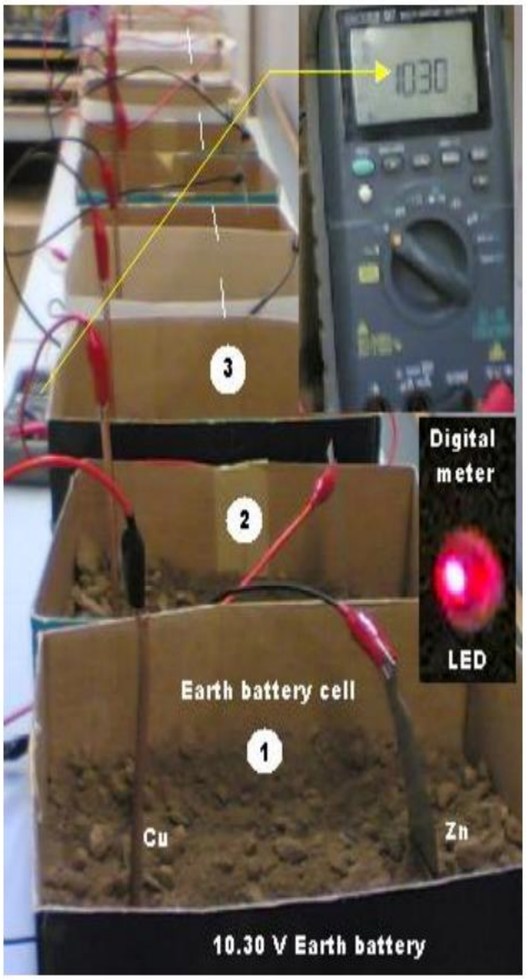
Voltage/Impact (V/I) curves for fixed zinc and movable copper electrodes are shown in Figure 2.

Even after 8 to 9 hours of continuous usage, the electrode did not rust. From south to north, the currents are stronger,

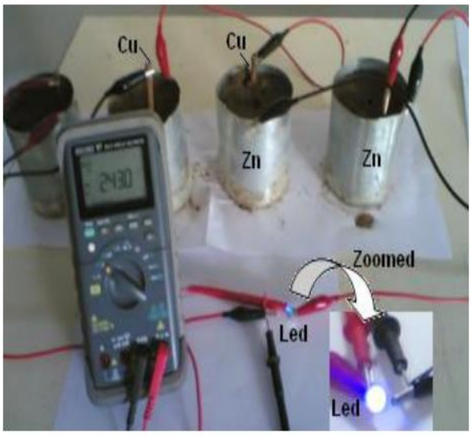
while from east to west, the currents are lesser. Electrodes with a positive north and a negative south were similarly more powerful. South-to-North currents were discovered. Although it was feasible to link earth battery cells in series to enhance the voltage, the electrodes from the bottom short circuited via earth electrolyte materials. Parallel connections of cells, on the other hand, resulted in higher currents because of larger surface areas. The current magnitudes are increased by the spiral electrode design because of the huge surface areas. To get the best results, the maximum voltage recorded was 0.9 0.35 V, with currents in the range of 3–0.25 A. A 15-fold increase in current was seen when the same experiment was carried out in the open air. It seemed as though some random potential source, in addition to the typical soil reaction voltage, was altering the DC earth battery voltage.

III. SERIAL OPERATION OF EARTH BATTERIES

The voltage on the bare ground surface cannot rise due to electrode shorting. To sum the voltage, we must first separate individual cells. Thirteen DC battery cells were made in separate paper boxes to illustrate serial accumulation of voltages. In order to boost the voltage, the separated earth battery cells were linked in series as illustrated in Fig. 3. From 8 to 10cm to 0.5 to 1cm, the distance between Zn and Cu electrodes in various cells changed (b). The DC voltage ranged from 10 to 12 volts, and the current was modest, yet an LED could still be lit using this setup. There was a mud resistance of tens of millions of Ohms between the electrodes. As indicated in Fig.4, copper and zinc plates of 16 inches square and I mm thick were coated with mud to minimise the resistance.



a. A twelve cells 10.30V/45mA earth battery



b. A four cells 2.43V/0.20mA earth battery

Fig.3. Experimental demonstration of serial connection of earth batteries

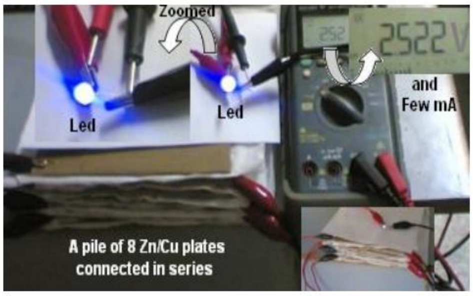


Fig.4 Four inch square Zn/Cu plate electrodes 2.5V/30 A earth battery

Using four cells in series resulted in 2.5 to 3.25V DC and a current of 30 A. It is important to remember that the voltage and current in dry much are affected by the moisture content. The high resistance between the electrodes causes the current to drop to zero when the system is completely dry. Moisture is necessary for the interaction between metal and soil. Instead of just using dry mud, we should use mud electrolyte. After prolonged use, the batteries' electrodes begin to corrode partly. A few studies on rusting have previously been done [20]. Investigations into electrodes with enormous surface areas are now underway.

CONCLUSIONS

Experiments on earth batteries with copper and zinc electrodes have shown promising results. Earth batteries have showed a good amount of potential for signalling, charging mobile phones, and providing white light lighting in distant regions after a month of operation. This fascinating investigation was carried out as part of a HEC-funded study on renewable energy. As a UET Lahore graduate (1984), it gives me great pleasure to present my study at ICEE 2008, which will take place at UET Lahore.

REFERENCES

[1] Gish, O. H., “The Natural Electric Currents in the Earth's Crust,” The Scientific Monthly, Vol. 32, pp. 5-2, 1989.

[2] G. M. Hopkins, “Experimental Science:Elementary, Practical and Experimental Physics. Munn &Co.,. pp. 437 – 451, 1902. [1] J. Cooper, “Powering Future Vehicles with Refuelable Zinc/Air Battery,” Science & Technology Review, pp. 6-13, October 1995.

[3] Lord Kelvin, Sea Battery: Method and Apparatus, US Pat. No. 4153757, End of 1800s. [1] Ryeczek, "U.S. Patent 4,457,988 Earth battery". July 3, 1984. [1] Daniel Drawbaugh, "U.S. Patent 211,322 Earth battery

for electric clocks". 1800s.

[4] M. Emme, "U.S. Patent 495,582 Ground generator of electricity". 1900s.

[5] Dieckmann, George F., "U.S. Patent 329,724 Electric Earth Battery". November 3, 1885. [1] K.S. Deffeyes, “Hubert’s Peak: The Impending World Oil Shortage,” Princeton University Press. 2002: ISBN 0-691-09086-6.

[6] D. Goodstein,” Out of Gas: The End of the Age of Oil. W. W. Norton’ Book 2005 ISBN 0-393-05857-3.

[7] H.H. Rogner,” An Assessment of World Hydrocarbon Resources,” Annu. Rev. Energy Environ, Vol. 22, pp. 217-262, 1997.

[8] M.C. Ruppert,” Crossing the Rubicon: The Decline of the American Empire at the End of the Age of Oil,” New Society. 2005: ISBN-13: 978- 0865715400.

[9] L.C. Kleveman,” The New Great Game: Blood and Oil in Central Asia,” Atlantic Monthly Press. 2004: ISBN 0-87113-906-5.

[10] K.S. Deffeyes, I.D. MacGregor, “ World Uranium Resources, Scientific America,” Vol. 242, pp. 66-67. 1980. [1]

[11] James Napier, “A manual of electro-metallurgy,” pp. 48-49, 1876

[12] A. A. Fesquet, “Oliver Byrne, and John Percy,” The Practical Metal-worker's Assistant. H.C. Baird & Co., pp. 529-530, 1878.

[13] E. Katz, "Alexander Bain". The history of electrochemistry, electricity and electronics; Biosensors & Bioelectronics.

[14] R. J. Edward,” Measurement of Soil Resistivity & Calculation of Earth Electrode Resistance. 15th February 1998.

[15] N. Khan, N. Mariun, Z. Saleem, N. Abas, “Fossil Fuels, New Energy Sources, and the Great energy crisis.