ELECTRICITY BY ENERGY RESOURCES

Sumit

INTRODUCTION

In physics, energy is a property of objects which can be transferred to other objects or converted into different forms. The "ability of a system to perform work" is a common description, but it is misleading because energy is not necessarily available to do work. For instance, in SI units, energy is measured in joules, and one joule is defined "mechanically", being the energy transferred to an object by the mechanical work of moving it a distance of 1 metre against a force of 1 newton.However, there are many other definitions of energy, depending on the context, such as thermal energy, radiant energy, electromagnetic, nuclear, etc., where definitions are derived that are the most convenient.

The world's energy resources can be divided into fossil fuel, nuclear fuel and renewable resources.

FORMS OF ENERGY

Ionization Energy

The ionization energy (IE) is qualitatively defined as the amount of energy required to remove the most loosely bound electron, the valence electron, of an isolated gaseous atom to form a cation.

Comparison of IEs of atoms in the Periodic Table reveals two patterns:

1. IEs generally increase as one moves from left to right within a period.
2. IEs decrease as one moves from down any given group.

1st ionization energy
$X \rightarrow X^{+} + e^{-}$

2nd ionization energy
$X^{+} \rightarrow X^{2+} + e^{-}$

3rd ionization energy
$X^{2+} \rightarrow X^{3+} + e^{-}$

Thermal Energy

In thermodynamics, Thermal energy refers to the internal energy present in a system due to its temperature. The concept is not well-defined or broadly accepted in physics or thermodynamics, because the internal energy can be changed without changing the temperature, and there is no way to distinguish which part of the internal energy is "thermal".

Nuclear Energy

The term nuclear binding energy may also refer to the energy balance in processes in which the nucleus splits into fragments composed of more than one nucleon. If new binding energy is available when light nuclei fuse, or when heavy nuclei split, either process can result in release of this binding energy. This energy may be made available as nuclear energy and can be used to produce electricity as in (nuclear power) or in a nuclear weapon. When a large nucleus splits into pieces, excess energy is emitted as photons (gamma rays) and as the kinetic energy of a number of different ejected particles.

Binding energy for atoms

The binding energy of an atom (including its electrons) is not the same as the binding energy of the atom's nucleus. The measured mass deficits of isotopes are always listed as mass deficits of the neutral atoms of that isotope, and mostly in MeV. As a consequence, the listed mass deficits are not a measure for the stability or binding energy of isolated nuclei, but for the whole atoms. This has very practical reasons, because it is very hard to totally ionize heavy elements, i.e. strip them of all of their electrons.

Mechanical Wave Energy

A mechanical wave is a wave that is an oscillation of matter, and therefore transfers energy through a medium.While waves can move over long distances, the movement of the medium of transmission—the material—is limited. Therefore, oscillating material does not move far from its initial equilibrium position. Mechanical waves transport energy.

TRANSFORMATION OF ENERGY

Energy transformation or **energy conversion** is the process of changing one form of energy to another form of energy. In physics, the term energy describes the capacity to produce certain changes within any system, without regard to limitations in transformation imposed.

Release of energy from gravitational potential: A direct transformation of energy occurs when hydrogen produced in the big bang collects into structures such as planets, in a process during which part of the gravitational potential is to be converted directly into heat

Release of energy from radioactive potential: Familiar examples of other such processes transforming energy from the Big Bang include nuclear decay, in which energy is released which was originally "stored" in heavy isotopes, such as uranium and thorium.

NONRENEWABLE RESOURCES

A nonrenewable resource is a resource that can be used up. Fossil fuels, which include coal, oil, and natural gas, are nonrenewable because it took millions of years for them to form. Once we use up our fossil fuels, they will be gone for good.

RENEWABLE RESOURCES

A renewable resource is fairly easy to replace. Renewable energy resources include wood, wind, sunshine, geothermal energy, biomass, and water stored behind dams in lakes and reservoirs**.**

ELECTRICITY IS PRODUCED IN POWER PLANTS

Generators in power plants produce most of the electricity we use. Inside a generator, an energy source is used to turn the blades of a wheel called a turbine. Energy is transferred from the energy source to the turbine blades. The turbine is attached to an axle and a very large magnet. The spinning of the turbine causes the axle and magnet to spin. Mechanical energy is transferred from the turbine to the magnet.

A huge coil of wire surrounds the magnet. As the magnet spins, it creates a flow of electricity in the wire. The mechanical energy of the spinning coil changes to electrical energy in the wire.

The wire is hooked up to power lines that allow the current to travel between the power plant and the electrical wires in homes, schools, and businesses. When you turn on a device like a TV or a computer, you direct the electricity to travel through the wires to run that device.

RECOPROCATING ENGINES

Small electricity generators are often powered by reciprocating engines burning diesel, biogas or natural gas. Diesel engines are often used for back up generation, usually at low voltages. However most large power grids also use diesel generators, originally provided as emergency back up for a specific facility such as a hospital, to feed power into the grid during certain circumstances.

ELECTROCHEMICAL

Electrochemical electricity generation is important in portable and mobile applications. Currently, most electrochemical power comes from closed electrochemical cells ("batteries").

Primary cells, such as the common zinc-carbon batteries, act as power sources directly, but many types of cells are used as storage systems rather than primary generation systems.

PIEZOELECTRICITY

The piezoelectric effect is understood as the linear electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry.The piezoelectric

effect is a reversible process in that materials exhibiting the direct piezoelectric effect also exhibit the reverse piezoelectric effect.

Many rocket-propelled grenades used a piezoelectric fuse.

APPLICATIONS

Currently, industrial and manufacturing is the largest application market for piezoelectric devices, followed by the automotive industry. Strong demand also comes from medical instruments as well as information and telecommunications.

HIGH VOLTAGE AND POWER SOURCES

A piezoelectric transformer is a type of AC voltage multiplier. Unlike a conventional transformer, which uses magnetic coupling between input and output, the piezoelectric transformer uses acoustic coupling. An input voltage is applied across a short length of a bar of piezoceramic material such as PZT, creating an alternating stress in the bar by the inverse piezoelectric effect and causing the whole bar to vibrate. The vibration frequency is chosen to be the resonant frequency of the block, typically in the 100 kilohertz to 1 megahertz range. A higher output voltage is then generated across another section of the bar by the piezoelectric effect.

Piezoelectric elements are also used in the detection and generation of sonar waves. Piezoelectric materials are used in single-axis and dual-axis tilt sensing.
Power monitoring in high power applications (e.g. medical treatment, sonochemistry and industrial processing).
Piezoelectric microbalances are used as very sensitive chemical and biological sensors.
Piezoelectric are sometimes used in strain gauges.

ACTUATORS

Loudspeakers : Voltage is converted to mechanical movement of a metallic diaphragm.
Piezoelectric Motors: Piezoelectric elements apply a directional force to an axle, causing it to rotate. Due to the extremely small distances involved, the piezo motor is viewed as a high-precision replacement for the stepper motor .

INFERTILITY TREATMENT

In people with previous total fertilization failure, piezoelectric activation of oocytes together with intracytoplasmic sperm injection (ICSI) seems to improve fertilization outcomes.

References:

WWW.Benno Maurus Nigg; Brian R. MacIntosh; Joachim Mester

WWW.Robert F. Speyer (2012). Thermal Analysis of Materials

WWW.Giancoli, D. C. (2009) Physics for scientists & engineers with modern physics

WWW.Dr. Rod Nave of the Department of Physics and Astronomy (July 2010). "Nuclear Binding Energy"

WWW.Harper, Douglas. "Piezoelectric"

WWW.Gautschi, G. (2002). Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers. Springer.

WWW.en.wikipedia.org