



ELECTROMAGNETIC STRESS– A DANGER TO HUMAN HEALTH

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Abstract: Electromagnetic fields (EMFs) originate from both man made as well as electrical source. As people now days are very much exposed to electromagnetic fields in their everyday life it is a matter of concern that whether these EMFs can be harmful to human health. On the basis of studies, an increased risk of childhood leukaemia which is associated with extremely low frequency range of the electromagnetic field spectrum has been assessed. There are various ranges of electromagnetic field-extremely low frequencies (ELFs), medium frequency and high frequency. Another frequency range known as Radio frequency (RF) emitting from wireless devices also affect the human health. Field intensities found in our environment are much higher than the normal field intensity which not only affects the humans but the animals, plants and living tissues also. Electromagnetic fields interaction with the environment can cause electromagnetic stress under certain circumstances.

I. Introduction

The question still exists that whether EMFs causes biological effects or not. Over the last few centuries our exposure to EMFs in our everyday environment has increased by a huge amount in our everyday life we are surrounded by extremely low frequency range of electromagnetic spectrum emitted by household appliances and power lines. In addition to this radio frequency emitted by wireless communication devices such as mobile phones and their base stations not only affect the human beings but the plants, animals and the living tissues also. Although there are a large number of reports regarding the biological effects caused by extremely low frequency range but still there is need for more research in this area. Some of the measures for the reduction of electromagnetic stress caused by these EMFs are also listed. The increased social and public interest in this area, based on the epidemiological studies associating the risk of amyotrophic lateral sclerosis (ALS), childhood leukaemia and adult brain cancer by the EMFs exposure of the power line radiation has been prompted by the World Health Organization (WHO) and WHO Environmental Health Criteria (EHC) to issue precautions against the Extremely Low Frequency EMFs so as to reduce the risks of electromagnetic stress.

II. Electromagnetic Field

If an electrically charged object is not in motion it creates an electric field in its surroundings, if it is in motion it produces a magnetic field around itself and the combination of both of the fields is known as electromagnetic field. The ways in which the charged particles and current behave in an electromagnetic field can be determined by Maxwell's equations and the Lorentz force law. For sake of convenience there are two ways to consider an electromagnetic field. They can either be assumed as continuous pattern of lines forming up a structure similar to waves or as individual particles like quantum. Earth's magnetic field is a perfect example of electromagnetic field that enables us for navigation with the help of compasses and shields us from the solar winds which can cause the ozone layer to become non-existent which protects us from harmful ultraviolet radiation.

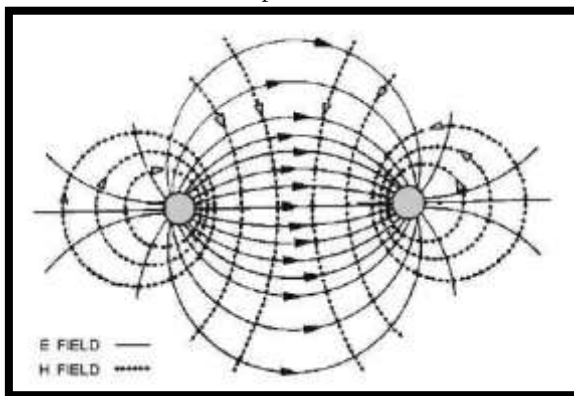


Figure 1: <http://electriciantraining.tpub.com/>

❖ Common radioactive emission particles:

Table 1: Skin Depth of Various metals and their Shielding Material

Radiation	Type of Radiation	(AMU) Mass	Charge	Shielding material
Alpha	Particle	4	+2	Paper, skin, clothes
Beta	Particle	1/1836	±1	Plastic, glass, light metals
Gamma	Electromagnetic wave	0	0	Dense metal, concrete Earth
Neutrons	Particle	1	0	Water, concrete, polyethylene, oil

III. Biological effects

Our electronic gadgets and appliances of daily life use produce electromagnetic radiations which can be harmful to our health and ecological system. We should be aware of the potential harms EMR poses and proper ways to use those appliances. Even a human body needs EMR to function properly as shown by researches.

A. Effects on animals

EMF has a lot of thermal effects on animals. RF radiation can heat up a body so much that may cause death. If RF is concentrated on a particular part of body, the tissues can be burnt and rendered non-functional, for instance if eye is exposed to concentrated RF radiations it may cause cataract to take place. It is been found that when telecoms mast was constructed for TV and cell phones transmissions, the nearby dairy cattle showed their health getting deteriorated. It was stated that microwaves emitted by the mast was responsible for lowering down of the milk yield and few cows even showed behavioural disorders.

This gets further proved when their behaviour and milk yield got back to normal when they were moved away from there but again started showing the same symptoms when they were placed nearby the mast. Several organs started internal bleeding leading to heart and circulatory collapse. Recently it is found that birds nesting within 200 m near mobile phones antennas were showing a considerable decline in life processes like hatching and breeding. Their death counts started rising up, the number of young born started going down, the pairs were being more aggressive towards each other.

B. Effects on Human Beings

Human body creates electrical signals within itself which, if are in range of an electromagnetic field, will have harmful impacts in your health. Energy waves like X ray gamma rays can be responsible for severing of the chemical and molecular bonds finally resulting in damaging of biochemical structures .EMR penetration in your body can cause biological stress, tissue damage and other health problems. Immune functions and neurological functions are adversely affected due to exposure .Children often get cancer. Some studies show that fatal diseases like breast cancer and Alzheimer's disease are often triggered due to high frequency energy rays .If DNA and cell growth is influenced it may result in cancer or birth defects. Memory loss, impaired brain function, heart conditions, chronic stress, foetal abnormalities, metabolic disorders are some others adverse harmful effects on health. It is found that electro-smog may disturb information flow between cells.

IV. LEAD

Lead is a chemical element found in the solar atmosphere. It belongs to the carbon group. Lead is extracted from the ores of zinc, silver and abundantly from copper. It is used because it is easy to extract and easy to work with.

A. Lead Properties

- Symbol: Pb
- Atomic Number: 82
- Atomic Mass: 207.2 amu
- Melting Point: 327.5°C (600.65 K, 621.5 °F)
- Boiling Point: 1740.0°C (2013.15 K, 3164.0 °F)
- Number of Protons/Electrons: 82
- Number of Neutrons: 125
- Crystal Structure: Cubic
- Density & 293 K 11.36 g/cm³
- Colour: bluish

B. Physical properties

- Lead is heavy, soft and grey solid.
- Lead is a bluish-white lustrous metal.
- Lead is soft, malleable and ductile.
- It has relatively poor conductivity of electricity compared to other metals.
- It has shiny surface when it is first cut but it slowly rusts and become dull.
- It is resistant to corrosion.

C. **Chemical properties**

- Lead dissolves slowly in water and in most of the cold acids.
- Lead reacts rapidly with hot acids.
- It has an ability to react with organic chemicals.
- Lead does not react with oxygen in the air and therefore does not burn.

D. **Uses of Lead**

- It is useful in roof flashing and cladding. Its main benefit is derived from harnessing its chemical properties.
- It is useful to staff working in hospitals, dental surgeries, laboratories and nuclear installations as its incredible density provides unrivalled protection from radiation.
- Lead stabilizers are added to PVC so as to protect kilometres of underwater pipelines and communication cables.
- Lead is widely used in battery technology as lead acid batteries are mainstay of storage for various renewable resources like solar cell, wind mill etc.
- Lead acid batteries are also used in cars, motorbikes, buses, trucks etc. to run them.
- Furthermore, lead acid batteries are important as a back-up emergency power supply in hospitals, telephone exchanges, mobile phone networks, public buildings.

E. **Drawbacks**

- Lead is one of the dangerous metals which have most damaging health effects on human beings.
- Lead can enter in human body through uptake of food, drinking water, air.
- Lead can cause several effects, such as rise in blood pressure, kidney damage, disruption of nervous systems etc.
- Lead accumulates in the body of water as well as soil organisms.

V. **Aluminium**

Aluminium is an abundant element found in the Earth's crust. It belongs to the boron family and having atomic number 13. It is represented with symbol Al. It is a silvery white, soft, ductile metal. It is a light weight metal and has an excellent heat and electricity conductivity. It is the second most malleable metal and the sixth most ductile.

A. **Properties**

- Melting point: 660 °C
- Boiling point: 2500 °C
- Weight: 2.700 kg/m³
- Density: 2,70 g/cm³
- Relative atomic mass: 26,98
- Oxidation number: 3
- Atomic radius: 143,1 pm
- Electrical conductivity: 36 m/Ohm·mm²
- Reflectivity: Good Reflector

In this article, Reflective property of aluminium is studied.

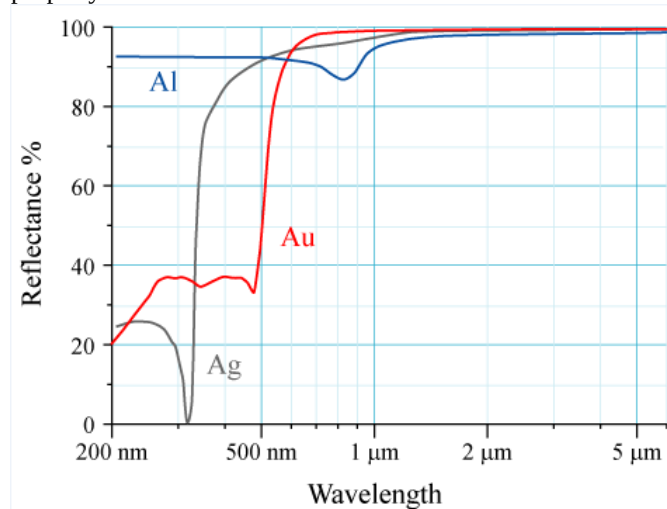


Figure 2: Metal Reflectance Vs Wavelength

This shows Aluminium has highest reflectance among all the metals. Thus it may reflect electromagnetic fields which are coming from various sources. The figure 3 shows the variation of different WIFI ranges with the potential barrier range in various metals.

Table 2: Wifi range and potential barrier range in metals

WIFI RANGE	Potential Barrier Range in metals
2.4	0.44
5.0	2.0
5.5	2.5
5.8	5.4

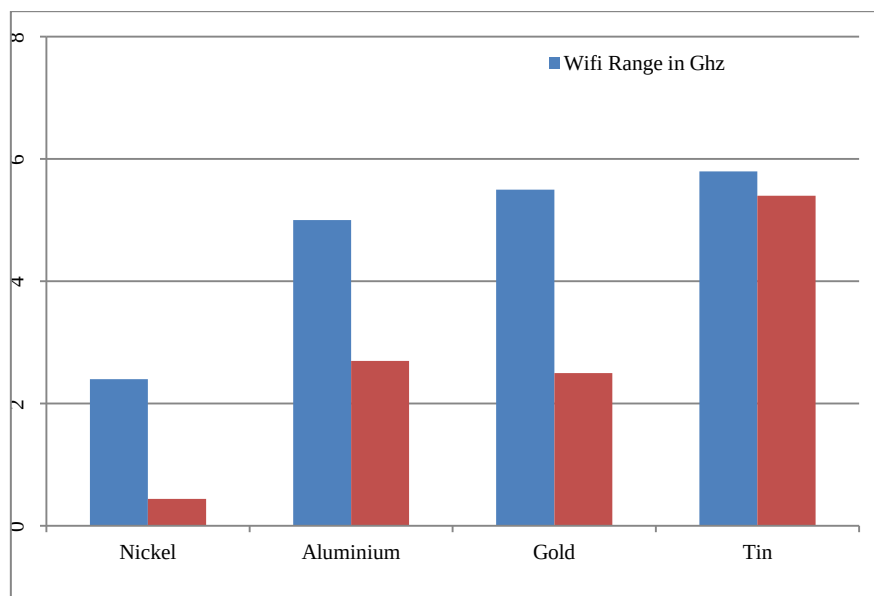


Figure 3: Wifi Range VS Potential Barrier (Metal)

B. Aluminium foil

Aluminium foil is aluminium prepared in thin metal leaves. Its thickness is less than 0.2 millimetres (8 mils). Household foil is 0.016 mm thick. Heavy duty household foil is 0.024 mm (0.94 mil). The foil is flexible, and can be easily bent or wrapped around objects. Since, Aluminium is non-magnetic and it is a good conductor. Thin sheet reflects all of incident electromagnetic fields. At frequencies more than 100 MHz, the electric field is attenuated by more than 80 decibels (dB) Aluminium foil can be used to protect ourselves with EMFs.

Example: Take a thin sheet of aluminium foil and wrap it around your electromagnetic field emitting devices like mobile phones, Wifi and any other gadget then you will see that there is no frequency range and signals available to that device. This is because aluminium has a good reflecting property due to which signals from outside will not be able to reach that device. Thus we can protect ourselves with EMFs by applying aluminium foil sheets.

C. Why aluminium is preferred over lead?

1. Cost Factor: Lead is expensive than aluminium. As aluminium is cheap thus it can be preferred over lead.
2. Weight: Lead is a heavy metal and its atomic mass is 207.2 ± 0.1 u and that of Aluminium is 26.981539 ± 0.0000008 u.
3. Reflectivity: Lead only absorbs the EMFs it does not reflect the rays but Aluminium reflects the EMFs which makes it suitable for the use.
- 4.

VI. Conclusion

From the above analysis, it is concluded that the use of Aluminium foil can be done in a very efficient way to guard ourselves from all kinds of harmful radiations of electromagnetic field. Aluminium foil is an exceptionally cost-effective medium to shield oneself from the growing danger of EM-radiations. However this is examined to develop effective ways or tools from Aluminium foil by the health and care departments to prevent the number of growing diseases and syndromes in all kinds of living organisms.

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