Review of: "A Mini-Review On MXene Based Textiles For Electromagnetic Interference Shielding Application"

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Abstract:

“….catastrophic effects of electromagnetic waves…”

This is an exaggeration and does not belong in a scientific paper. Although EM waves could be made to cause permanent damages to other electronic, the EMI that the authors are talking about in this paper does not fall in that category, which is called IEMI (intentional EMI).

Introduction:

“…the earth's magnetic field…”

Earth’s magnetic field is not time-varying, hence is not an electromagnetic field, and should not be mentioned in here as an EMI.

“…vehicle traffics…”

How does traffic creates EMI? Yes, the cars and their electronic could be a source for electromagnetic waves, but how the traffic itself creates EMI?

“…possesses a disastrous effect on living beings and the environment…”

This seems exaggerated. There are multiple things wrong here:

EMI means interference caused by other electronics (sources) that happens unintentionally – emphasis on unintentional. If someone put a cell phone near their head and then develop a brain tumor, that is not because of EMI of the cell phone, but because of its intentional radiation to talk to the BTS tower. And yes, electromagnetic waves could cause health problems, but as explained, that is not called EMI.

“…active and passive devices in order to minimize…”

What is a passive device?

How can a passive device cause emission?

“…minimize emissions and to make the equipment less vulnerable to external interference through proper designing of

equipment."

Two completely difference concepts are discussed here:

- EMI (electromagnetic interference): which means a source creates EM waves that cause interference with your device.
- EMC (electromagnetic compatibility), which means the device should not cause EM waves that cause interference for other electronics in its vicinity.

The standards, the test setups, and (most importantly) the mitigation techniques for each concepts is different from the other one. The way the authors have wrote this sentence, it seems these two concepts are the same.

"Filtering is one of the common and also direct approaches to getting rid of unwanted signals. It usually starts with an AC line filter, which keeps unwanted signals out of the power supply and powered circuits preventing the addition of internal signals to the source."

Authors suddenly jumped to AC filtering topic with not transition between the previous sentience, which was talking about electromagnetic waves. These waves are present in the MHz and GHz range and are not relevant to AC filtering in power supplies, which is done one a 50-60Hz line. Even if the authors were trying to talk about the switching power supplies that have a switching frequency of few hundred kHz, still there is a jump in the context.

"Shielding is considered significant as the electromagnetic waves are reflected into the enclosure while also taking up the waves that are not reflected."

Not clear what the authors mean.

"…comfort, breathability, and sustainability to various shielding applications."

Why comfort matters in shielding application? For example, if one puts a shield around an IC, why would he/she care if it is comfortable or not?

I get it that this paper is talking about comfort for human, but that is what I got from the sentence referenced above.

The first graph (called the Graph) is not relevant to the topic the paper is talking about. I suggest to remove the graph and its accompanying text.

Mechanism of shielding:

"As shown in figure 1, the phenomenon of interaction or the mechanisms…"

I would not call it phenomenon. It is just interaction between an EM wave and not only a shielding surface, but any arbitrary surface. The interactions shown in plot 1, happen regardless of the surface type or material. Only the magnitude and phase of the reflected wave, transmitted wave change depending on the material. As for the absorption, again, it

happen any way, only some material have a higher absorption rate for a frequency range, and some have lower.

"…also considered the primary shielding mechanism…"

This is not technically correct. I suggest the authors take a look at these reference and look for the term "Shielding Effectiveness"

[1] H. Ott, *Electromagnetic Compatibility Engineering*, John Wiley & Sons, New York, 2009.

[2] C. R. Paul, *Introduction to Electromagnetic Compatibility, 2nd Ed.*, Wiley Series in Microwave and Optical Engineering, 2006

"…, these reflected radiations may be undesirable to the environment as well as to living beings, and hence absorption mechanism for shielding is more preferred to reflection…"

This does not sound logical, because the incident wave was already present in this medium. Reflecting off of a shield in a device, at most can reflect the same amount as the incident wave. The statement does not seem valid by this explanation.

"The absorption mechanism is increased with increasing electrical or magnetic dipoles of the shielding material, due to its interaction with the magnetic field of EM waves…"

1. "electric dipole" is the correct terminology, not "electrical dipole"
2. What does it mean to absorption increase by increasing electric and magnetic dipole? Please explain.

" …when rays in the form of waves strike it…"

This is technically wrong. EM wave shown in the form of rays in fig 1 are only representation of something called the wave front. Although "ray tracing" is an approach to solve wave equation under certain conditions, it does not apply here.

"…These forced oscillating charges act like antennas, causing surface reflection…"

No, not really. They do not act like antenna. When an incident wave hits a conductor's surface, it induces a current on the surface. This current then generates EM field.

"…Depending on the pattern, the signal wave may reflect in a variety of directions connected with a charge that oscillates

in a signal. As a result, the signal is dispersed, and there occurs a signal loss by attenuation due to reflection and this reflection loss R is defined as…"
Please refer to my previous comment, this is not what actually happens. This explanation is misleading.

"…EMI shielding comprises two regions, the near field shielding region and the far field shielding region. Electromagnetic radiation having high frequencies is able to penetrate only the near surface region of an electrical conductor. This is termed as the skin effect.…"
This is an inaccurate (and probably wrong) explanation of skin depth.

"…It is understood from the above equation that the skin depth reduces as the frequency rises and the conductivity or permeability rises.…"
Yes, skin depth reduce with the increase of frequency, but how do authors conclude that mu and sigma change by frequency in this formula? They do not based on this formula; They are only parameters of the medium.

Health Effect of EMI:
My comment is about the section title: "Health Effect of EMI". As I mentioned before, EMI is so week (negative tens of dB) that its effect on a living organ is not even comparable to a cellphone next to that organ. The title "Health Effect of EM wave" however is correct. The author used a right caption for fig. 2. EM radiation should not be confused with or mistaken for EMI or even EMC.

"…can interfere with or damage electronic devices, changing the voltage in the proximity so that the components like regulators, switches, and circuit boards in electronic equipment turn faulty…"
This sentence is incorrect and misleading. EM waves can in general do all these things but has to be designed for, the power needed for such damages or catastrophic impact on other devices cannot be generated by a cell phone or other electronics this paper is talking about. As mentioned before, that is not called EM anymore, but Intentional-EM. For a rough comparison, a cell phones generated a power in the range of a few hundreds of milli-watt (mW), whereas an Intentional-EM generator needs to generate powers in the order of hundreds or thousands of kilo-watt (KW).
The damages or even causing faults in the circuits cannot happen from the EM coming from a tiny device used in IOT, cell phones, GPS, and so on.

Conclusion:

The conclusion needs to be adjusted according to the comments provided.