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Comment

Comment on Saleem et al. Thermal Case Study of Cilia Actuated Transport of Radiated Blood-Based Ternary Nanofluid Under the Action of Tilted Magnetic Field. *Coatings* 2022, *12*, 873

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1. First Error

The base fluid in [1] is blood and the nanoparticles are alumina (Al_2O_3), silicon dioxide (SiO_2), and titanium dioxide (TiO_2). Their thermophysical properties are presented in Table 1 in [1], where the alumina (Al_2O_3) electrical conductivity is $\sigma = 36.9 \times 10^6 \left(\Omega^{-1}.m^{-1} = S.m^{-1}\right)$.

This value is wrong for the following reason: Alumina is fundamentally characterized by its low electrical conductivity, placing it in the category of insulating materials.

In reference [2], Alumina/multiwalled carbon nanotube (MWNT) composites with different MWNT contents were prepared using the spark plasma sintering technique. The electrical conductivity and dielectric properties of the composites were investigated. In Figure 1, in reference [2], the electrical conductivity of alumina/MWNT composites is presented as a function of MWNT content. The case with zero MWNT corresponds to pure alumina and the electrical conductivity is $\sigma = 10^{-12} \left(S.m^{-1}\right)$.

In reference [3], the electrical conductivity of alumina–silicon carbide (Al_2O_3–SiC) and alumina–multiwalled carbon nanotube (Al_2O_3–MWCNT) nanocomposites were studied. In Table 1, in [3], the pure alumina electrical conductivity values are $\sigma = 6.87 \times 10^{-10} - 1.22 \times 10^{-12} \left(S.m^{-1}\right)$.

In reference [4], the authors present research on the production of CNT/Al_2O - composites with improved mechanical, electrical, and thermal properties.

This was achieved by inserting different quantities of CNT into alumina. They found that by increasing the CNT content in the alumina, the CNT/Al_2O_3 electrical conductivity increased. In Figure 5A, in [4], it is clear that the electrical conductivity of pure alumina (zero CNT content) is $\sigma = 10^{-13} \left(S.m^{-1}\right)$.

The values presented in references [2–4] are experimental and agree with values $10^{-10} \left(S.m^{-1}\right) - 10^{-12} \left(S.m^{-1}\right)$ given by UNIPRETEC, a ceramic company in China, which produces alumina.

A paper published recently in the *Chinese Journal of Physics* [5] confirms that the value $\sigma = 36.9 \times 10^6 \left(S.m^{-1}\right)$ is wrong.

2. Second Error

In Table 1, in [1], the silicon dioxide (SiO_2) electrical conductivity is $\sigma = 3.5 \times 10^6 \left(\Omega^{-1}.m^{-1} = S.m^{-1}\right)$.

This value is wrong for the following reason: Silicon dioxide (SiO_2) is an excellent electrical insulator, not a conductor, because it has no mobile electrons or ions with which to carry an electric current.

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In Table 1, the silicon dioxide electrical resistivity is $10^{17}(\Omega\text{cm}) = 10^{15}(\Omega\text{m})$. Electrical conductivity is the inverse of electrical resistivity and is $10^{-15}\left(\Omega^{-1}\text{m}^{-1}\right)$. The error is huge.

Table 1. Important properties of SiO_2 [6].

Crystal Structure	Amorphous
Atomic weight	60.08 g/mole
Density	2.27/2.18 g/cm^3
Molecules	$2.3{\cdot}10^{22}$/cm^3
Specific heat	1000 J/kg-K
Melting point	1700 °C
Thermal expansion coefficient	$5.6{\cdot}10^{-7}$/K
Thermal conductivity	1.1W/m-K–1.4W/m-K
Relative dielectric constant	3.7–3.9
Dielectric strength	10^7V/cm
Energy bandgap	8.9 eV
DC Resistivity	$\simeq 10^{17}$ Ωcm

3. Third Error

In Table 1, in [1], the titanium dioxide (TiO_2) electrical conductivity is $\sigma = 2.4 \times 10^6\left(\Omega^{-1}.\text{m}^{-1} = \text{S.m}^{-1}\right)$. This value is wrong for the following reason:

The Fraunhofer Gesellschaft in Germany is a reliable leading applied research organization. In its annual report 2020, in section Titanium Oxides-Electrical All-Rounders in Fraunhofer [7] there is a table with the electrical resistivity of different titanium oxides (TiO_2, Ti_9O_{17}, Ti_6O_{11}, Ti_5O_9 etc.). The electrical resistivity of (TiO_2) is $10^{12}(\Omega\text{cm}) = 10^{10}(\Omega\text{m})$. The electrical conductivity is the inverse of resistivity and the electrical conductivity of (TiO_2) is $\sigma = 10^{-10}\left(\text{S.m}^{-1} = \Omega^{-1}\text{m}^{-1}\right)$. This value is completely different from that in [1].

AZoM [8] is an online publication for the Materials Science community.

From Table 2, it is seen that the (TiO_2) electrical resistivity, at 25 °C, is again $10^{12}(\Omega\text{cm}) = 10^{10}(\Omega\text{m})$, which corresponds to electrical conductivity $\sigma = 10^{-10}$ $\left(\text{S.m}^{-1} = \Omega^{-1}\text{m}^{-1}\right)$.

Table 2. Typical physical and mechanical properties of titanium dioxide (TiO_2) [8].

Property	Value
Density	4 gcm^{-3}
Porosity	0%
Modulus of rupture	140 MPa
Compressive strength	680 MPa
Poisson's ratio	0.27
Fracture toughness	3.2 Mpa.m$^{-1/2}$
Shear modulus	90 GPa
Modulus of elasticity	230 GPa
Microhardness (HV 0.5)	880
Resistivity (25 °C)	**10^{12} ohm.cm**
Resistivity (700 °C)	2.5×10^4 ohm.cm
Dielectric constant (1 MHz)	85
Dissipation factor (1 MHz)	5×10^{-4}
Dielectric strength	4 kVmm^{-1}
Thermal expansion (RT-1000 °C)	9×10^{-6}
Thermal conductivity (25 °C)	11.7 WmK^{-1}

The error is huge. A paper with exactly the same error has been criticized by the present author, in [9].

4. Fourth Error

The blood specific heat and thermal conductivity are presented in Table 1 in [1]. The blood dynamic viscosity is included in reference [10] and is $\mu = 0.003863\left(\mathrm{kgm^{-1}sec^{-1}}\right)$ for youth and $\mu = 0.004553\left(\mathrm{kgm^{-1}sec^{-1}}\right)$ for middle-aged people.

Thus, the blood Prandtl number is

$$\mathrm{Pr} = \frac{\mu_f C_{pf}}{k_f} = \frac{0.003863\left(\mathrm{kgm^{-1}sec^{-1}}\right) \times 3594\left(\mathrm{m^2sec^{-2}K^{-1}}\right)}{0.492\left(\mathrm{kgmsec^{-3}K^{-1}}\right)} = 28.22$$

for youth and

$$\mathrm{Pr} = \frac{\mu_f C_{pf}}{k_f} = \frac{0.004553\left(\mathrm{kgm^{-1}sec^{-1}}\right) \times 3594\left(\mathrm{m^2sec^{-2}K^{-1}}\right)}{0.492\left(\mathrm{kgmsec^{-3}K^{-1}}\right)} = 33.26$$

for middle-aged people.

These Prandtl numbers agree with those calculated in reference [11]. However, in Figures 5–7 in [1], results are presented for Prandtl numbers Pr = 1, 1.2, 1.4 and 1.6, and in Table 3 in [1], results are presented for Pr = 1. All these results do not correspond to blood and are wrong.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The author declares that there are no conflicts of interest.

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