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# Investigating the possibility of transferring important and useful materials and compounds at high weights from other planets to Earth

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**ABSTRACT:**

In this article, we will examine and study the provision of the infrastructure required for the new concept of using technology to transfer various energy sources from other parts of the galaxy to planet Earth. The direct connection of energy with providing important infrastructure for the activity and growth and promotion of industry, trade and science by future generations that form the basis of their lives is examined, and new theories are presented on how to sample energy sources such as metals, minerals and elements found on other planets. In this regard, the application of robotics and various branches of chemistry and physics can provide highly advanced equipment and tools that humanity and future generations can use to transfer various samples from other planets to planet Earth and store and preserve them, and benefit from these materials and compounds. The use of nanotechnology in the construction of large and durable spacecraft and equipment for the transfer of important resources from other planets to Earth is discussed.

**Keywords:** Extraplanetary Resource Harvesting, Space Logistics, High-Weight Material Transport, Nanopolymers, Nanocomposites, Polymer Reinforcement, Potential Energy, Kinetic Energ

## Introduction:

Throughout human history, many hypotheses have been put forward by scientists around the world about the planets and their resources, energies and the existence of life of all kinds, some of which have been correct and some of which have been rejected. These hypotheses are very important in any situation to achieve correct scientific results. In the field of energy, formulas for calculations have been dedicated to it. Today, many wars and disputes have arisen between different nations, and all governments negotiate with each other about providing the necessary energy for future generations, but is this the solution to providing energy for countries? Do all governments have the same and sufficient amount of energy for future generations?

Certainly, energy resources are not distributed equally throughout the Earth, for example, Africa has the most diamonds, Russia, Asian countries and the United States have the most gold, Saudi Arabia has the most oil reserves, and Australia, Russia, Poland, Canada and Iran have the highest density of mines. Some countries have only renewable energy resources, and some have huge resources of non-renewable energy such as fossil fuels and uranium. In this regard, scientists have drawn their attention to many planets and systems and have spent a lot of capital and energy to achieve new space-based technologies, and this is the beginning of a great progress. Because with the deployment of advanced machines and robots on other planets, humanity may conclude that other planets are not habitable and urbanized and cannot be chosen as safe environments, and on the other hand, planet Earth is facing an energy shortage. In this situation, we can transfer the resources available on any accessible planet to planet Earth, protect and preserve them in special reservoirs, and use them in line with modern science and industry.

## Materials and Methods:

Collecting and transporting large weights of important and widely used resources from other planets requires very robust and advanced machines and super-equipment that can be used automatically and remotely to extract important resources on other planets.

Some of these equipment sent to planets near the Sun must be resistant to very high temperatures, and some of them sent to planets further from the Sun must be resistant to gravitational energies and toxic or corrosive substances and compounds of the planets. Therefore, plasma materials may not be applicable due to their reaction with electrical and gravitational currents. High-temperature resistant silicons that have been adapted to other planets using nanotechnology could be very important in this field. However, due to the soft texture of these materials, they are not sufficient for building super-equipment.

High-temperature resistant materials and coatings, including metal alloys, ceramics, and nanotechnology-improved surfaces, tungsten, molybdenum, niobium, tantalum, rhenium, and their alloys, show exceptional thermal resistance. These refractory metals retain their strength and stability.

Hafnium and tungsten are abundant and inexpensive materials, and the process used to make these heat-resistant emitters is well known.

Using nanoscience, we can produce ceramics and composites that can be used to build large, widely used machines. With this equipment, it will be possible to extract materials, metals, and important resources from other planets. Whether nanopolymers can be used to make these devices is a matter of investigation. Nanopolymers have a texture that is highly resistant to electrical and gravitational currents, and some of them have hard and resistant surfaces.

Nickel-based superalloys, titanium alloys, refractory metals, ceramic composites, among other materials, have become heat-resistant and irreplaceable materials. However, some of these materials have not reached resistances above 5,000 Kelvin due to their lack of use in nanotechnology, and this issue can be studied and researched by scientists and professors and used in the construction of super space mining equipment and even spacecraft and extrasolar satellites.

## Results:

Different elements and metals exhibit different resistances to heat and electricity. By assessing the relative strength of each element, one can determine its usefulness in constructing machines and equipment outside the Earth's atmosphere.

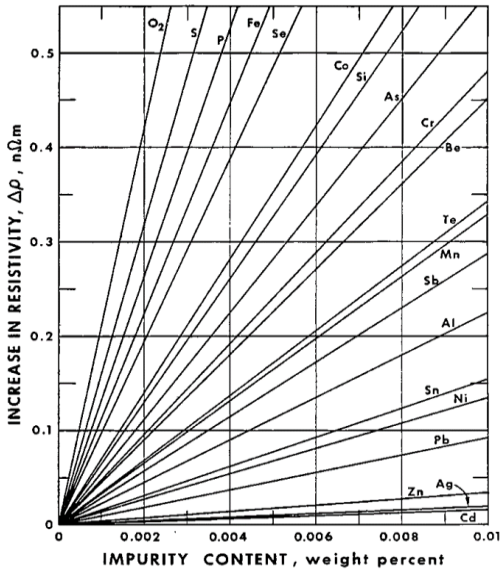



**Figure1: Materials & Properties: Thermal & Electrical Characteristics**

Each of the materials on Earth's surface has a different resistance and stability to electrical and gravitational waves. The table below lists the resistance of a number of these materials in ohms law.

According to the information in the table above, materials such as glass, Teflon, and quartz are better resistance insulators, but metals such as gold, silver, copper, and aluminum have a higher temperature resistance index and lower resistance insulators. With this information, materials that are more important for research and investigation are identified as ineffective than other materials.

| Material | Resistivity (Ω m) | Type | Temperature Coefficient (α) |
|---|---|---|---|
| Silver | $1.6 \times 10^{-8}$ | Conductor | $3.8 \times 10^{-3}$ |
| Copper | $1.7 \times 10^{-8}$ | Conductor | $3.9 \times 10^{-3}$ |
| Gold | $2.4 \times 10^{-8}$ | Conductor | $3.4 \times 10^{-3}$ |
| Aluminum | $2.6 \times 10^{-8}$ | Conductor | $3.9 \times 10^{-3}$ |
| Mercury | $9.8 \times 10^{-7}$ | Conductor | $9 \times 10^{-4}$ |
| Iron | $9.7 \times 10^{-8}$ | Conductor | $5 \times 10^{-3}$ |
| Carbon (pure) | $3.5 \times 10^{-5}$ | Conductor | $-0.5 \times 10^{-3}$ |
| Silicon | 640 | Semiconductor | $-7.5 \times 10^{-2}$ |
| Germanium | 0.46 | Semiconductor | $-4.8 \times 10^{-2}$ |
| Glass | $\sim 10^{9}$ to $10^{14}$ | Insulator | |
| Teflon™ | $\sim 10^{13}$ | Insulator | |
| Sulfur | $\sim 10^{15}$ | Insulator | |
| Quartz | $7.5 \times 10^{17}$ | Insulator | |

**Figure2: Electric Conductivity, Resistance and Ohm's Law.**

The difference between pure metals and nanocomposites and nanoceramics is the higher resistance range of these materials, which distinguishes these two groups from each other. Polymer-based and ceramic-based nanocomposites with more and longer polymer branches are expected to have very high resistance to high temperatures and gravitational and electric fields because they have a higher dispersion of nanoparticles or nanofillers within the polymer matrix.

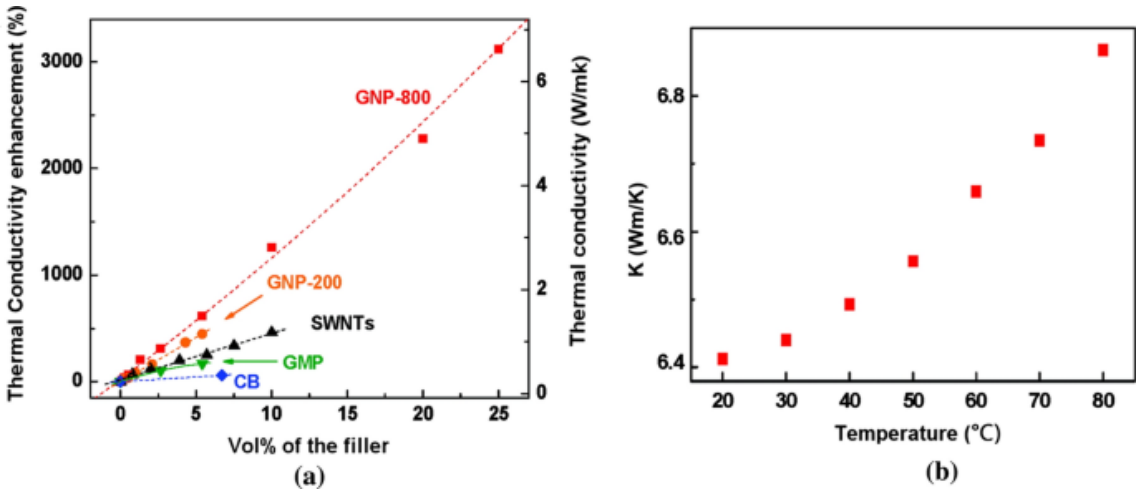



**Figure3: Polymer nanocomposites based on graphite nanoplatelets (GNPs)**

Surface-coated polymer nanocomposites containing aligned nanowires are known as high-performance dielectrics at high temperatures. This is because the high density of nanowires in the nanocomposites results in a high dielectric constant, and the outer insulating layers effectively suppress the electrical conductivity and reduce the disordering of nanoparticles on the surface. The figure below shows the resistance curves of these nanocomposites or aligned nanotubes.

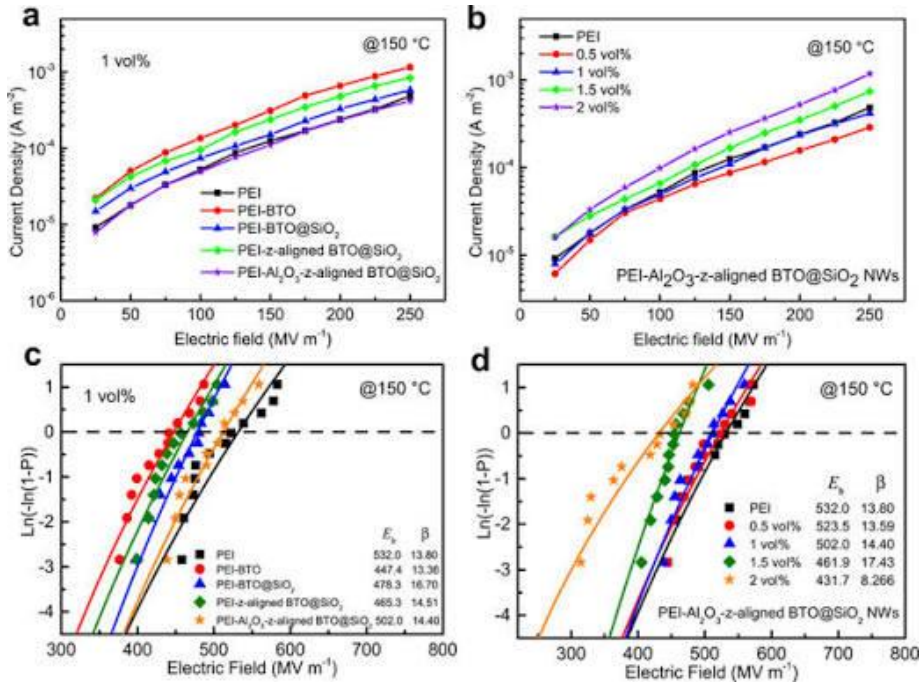



**Figure4: Dielectric constant anddissipation factor of polymer nanocomposites withdifferent volume fraction of NWs at 150°C and 1 kHz.(b) Frequency-dependent dielectric spectra ofnanocomposites containing 1 vol% of NWs at 150°C**

The impact of molecular and macromolecular processing of rare and valuable materials such as hafnium zirconium, molybdenum tungsten filaments, niobium, tantalum and rhenium at the nanoscale and even the production of strong and durable alloys of these materials can lead to the construction of advanced and durable technologies and superstructures in space, with which equipment can be used to extract energy resources from planets near the Sun. Below is a diagram of the resistivity of one of these metals.

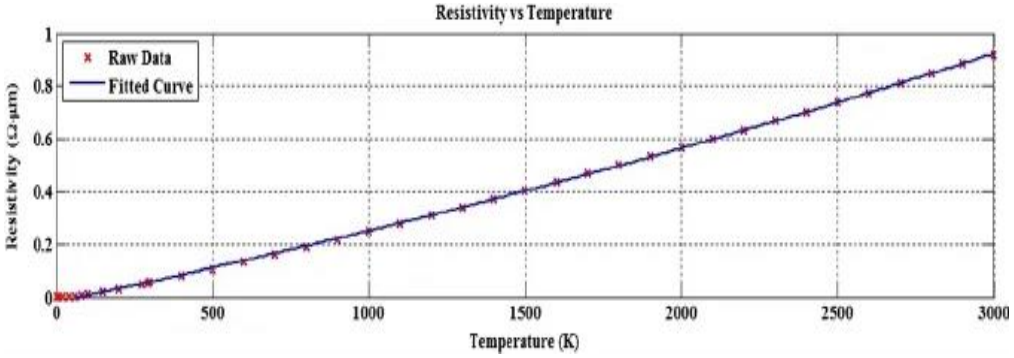
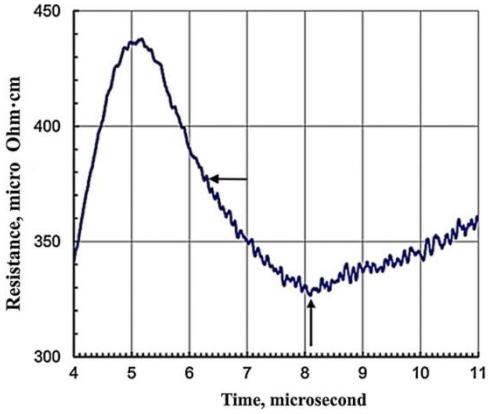



**Figure5: Empirical curve fit of measured resistivity of tungsten against temperature.**

**Figure6: Thermophysical properties for hafnium carbide (HfC) versus temperature from 2000 to 5000 K**



The percentage of population growth in different countries varies, but in general, considering energy resources, population growth causes a decrease in energy resources because the percentage of energy consumption in industries, science and technology increases, and in this case, a solution must be thought of to replace the resource that is being consumed and is running out. On the other hand, it may not be possible after years of effort and research in the field of creating a human environment on other planets, and at that time, providing equipment and human forces to extract useful resources from other planets is very important. The next figure is a graph showing the impact of population growth on energy consumption.

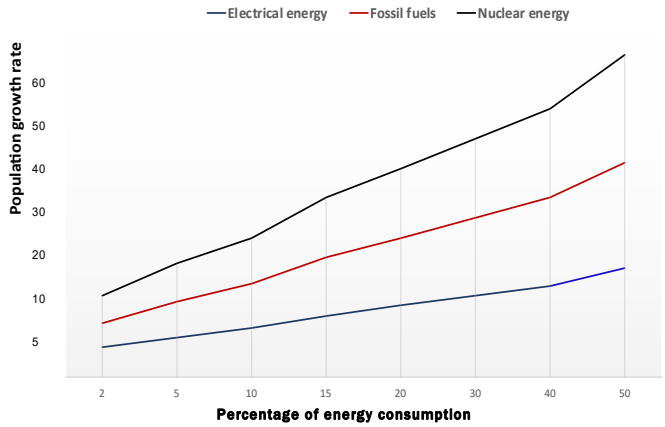



**Figure7: Diagram of the impact of population growth on the consumption of electrical and nuclear energy and fossil fuels.**

## Discussion:

According to the study of scientists in the field of studying the concept of energy, they have classified it into different branches. This classification has developed the concept of energy and its various branches can be studied and researched. In the planets of the solar system, energy is supplied from various sources, which can be named according to the following branches:

Non-renewable energy sources on other planets have been studied, and theories and evidence suggest that Mars is made of iron, nickel, and sulfur. Its core is surrounded by a rocky mantle between 1,240 and 1,880 kilometers thick, and above it is a crust of iron, magnesium, aluminum, calcium, and potassium. This crust is between 10 and 50 kilometers deep. Therefore, the important elements mentioned can be transported to Earth with huge and advanced machinery and equipment and made available to different societies for exploitation as needed.



**Figure8: The possible existence of vast mines and reserves on the surface of Mars that can be exploited with advanced equipment and machinery.**

Jupiter is mainly composed of hydrogen and helium. Deep in the atmosphere, the pressure and temperature increase, and the hydrogen gas is compressed into a liquid. This creates a large, homogeneous ocean of hydrogen and helium in the solar system - an ocean made of hydrogen instead of water, which is made of hydrogen, which is separated from the hydrogen atoms due to the high pressure, making the liquid like a metallic conductor. Jupiter's rapid

rotation is thought to drive electrical currents in this region, with the spinning liquid metallic hydrogen acting like a dynamo, creating the planet's powerful magnetic field. On Earth, these resources could be used to create modern, low-risk helium and hydrogen nuclear power plants, replacing older, more dangerous ones.

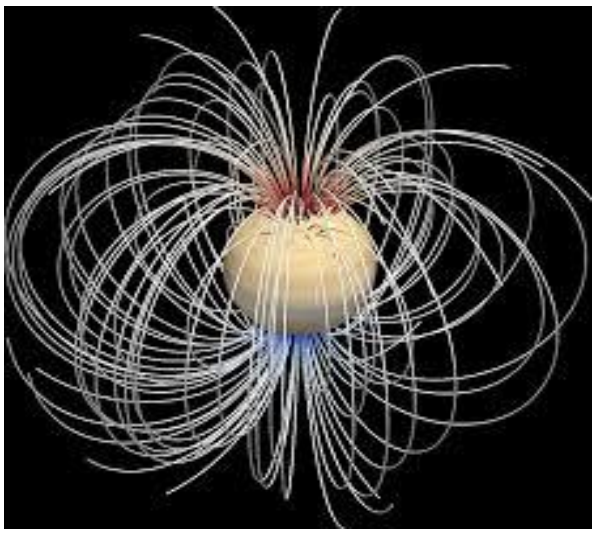


**Figure9: Magnetic fields resulting from compressed helium and hydrogen on the surface of Jupiter.**

Planets close to the Sun, such as Mercury, have relatively volatile elements such as potassium and sulfur in their crust, and Venus has a thin upper layer containing small amounts of hydrogen-containing compounds such as hydrogen chloride (HCl) and hydrogen fluoride (HF). Carbon monoxide (CO), water vapor ($H_2O$), and molecular oxygen ($O_2$) are also found.

A large portion of the planet's hydrogen appears to have escaped into space, with the remainder formed as sulfuric acid ($H_2SO_4$) and hydrogen sulfide ($H_2S$). The lower layers of Venus contain significant amounts of coarse particles of liquid and solid sulfur. Therefore, spacecraft to these two planets must be able to withstand temperatures as high as 740 K, and spacecraft to planets further from the Sun must be able to withstand gravitational and electric fields and be corrosion-resistant.

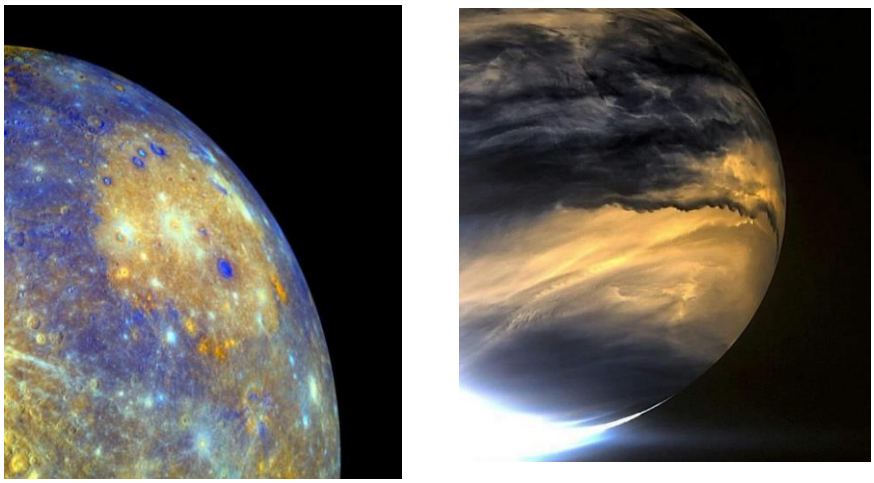


**Figure10: The most realistic photo of the planet Venus on the right and the planet Mercury on the left, provided to users by NASA.**

Saturn is very thick and deep, and its atmosphere is very similar to Jupiter's. So far, methane ($CH_4$), ammonia ($NH_3$), ethane ($C_2H_6$), phosphine ($PH_3$), acetylene ($C_2H_2$), methylacetyl ($C_3H_4$), propane ($C_3H_8$), and molecular hydrogen ($H_2$) have been observed, which are widely used materials in various chemical, pharmaceutical, and cosmetic industries.

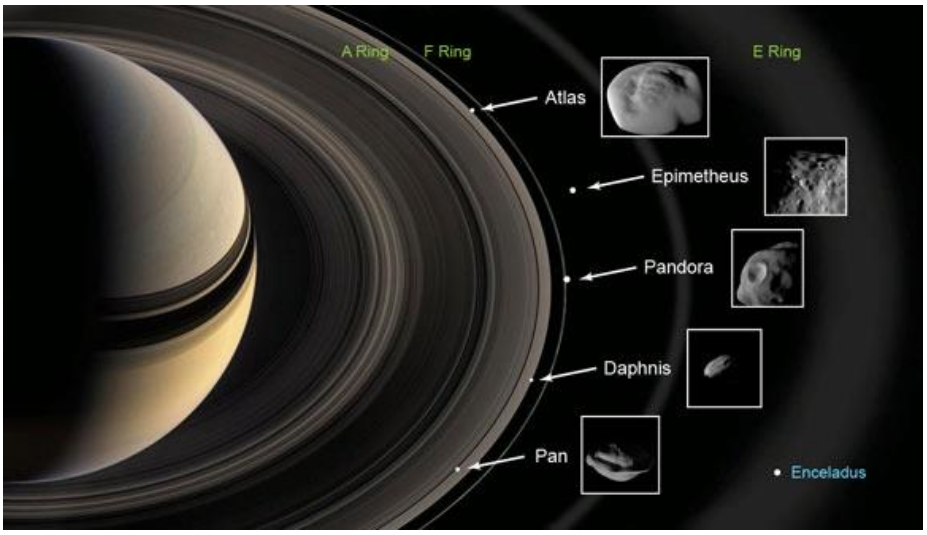



**Figure11: Image of the planet Saturn and the planet's three distinctive rings, which make it impossible for humans to access these resources.**

Saturn has huge magnetic fields and vast gravitational currents that make human presence impossible due to the surrounding rings and these strong forces, and the only way to access the useful resources of this planet is through large and advanced nano-spacecraft.

## Conclusion:

Each of the planets in the solar system is covered with important compounds and elements that can be discovered with further exploration and wider sampling. Modern spacecraft are being built with high efficiency and greater safety, and if we reach the stage of extracting these materials from other planets, we will need large equipment and spacecraft with storage tanks and tools required for extraction. Lighter spacecraft with greater capacity will greatly help humanity in this regard.

The first important issue in the construction of equipment is the material of these spacecraft, which are usually high-strength alloys of aluminum, titanium and stainless steel, which have been commonly used for decades. By applying nanoscience and producing thinner and lighter sheets, while being more resistant in every way, it is possible to achieve the desired equipment and machines. According to this theory, it is possible to make nanocomposites that are very resistant and have a lighter weight, and these compounds can be used for very large spacecraft and mining equipment.

Even in the construction of astronaut suits that are compatible with very high temperatures, the body material can be made more resistant with nanotechnology and the amount of damage and destruction of this equipment can be reduced by using higher operating speeds.

Polymer and metal matrix nanocomposites can each have very high performance in this field and can be used to manufacture aerospace equipment. Because they have high compatibility at high temperatures and are resistant to gravitational and electric fields in space. Also, with lighter weight and more coherent texture, these compounds can be used to manufacture large equipment and spacecraft.

It is hypothesized that by adding metals such as tungsten, hafnium, titanium, or nickel to polymer-based nanocomposite layers, the desired resistant and ultra-advanced surface can be achieved.

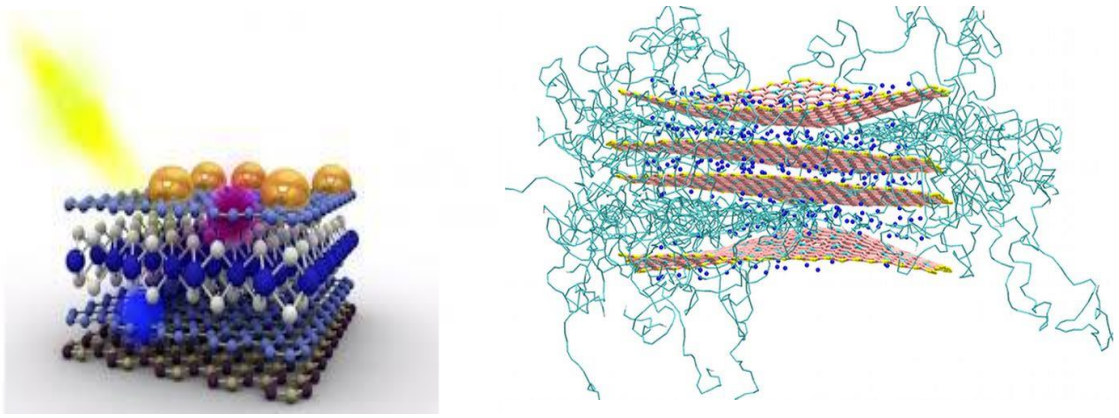


**Figure12: The structure of polymer-based nanocomposites on the right and metal-based ones on the left, clearly showing the density of nanotubes in the layers.**

**Supplementary materials:**

| METAL/ALLOY | Melting point | Electrical resistance $10^{-8}$ Ωm | Thermal capacitykJ/kg K | Hardness |
|---|---|---|---|---|
| Cu | 1083 | 1.68 | 0.385 | 50HV |
| Ag | 961 | 1.59 | 0.236 | 25HV |
| Au | 1063 | 2.44 | 0.13 | 107HV |
| Al 6061-T6 | 659 | 2.82 | 0.897 | 40HV |
| Co | 1495 | 6.24 | 0.42 | 1043HV |
| Mo | 2623 | 4.99 | 0.272 | 1530MPa |
| Nb | 4744 | 152 | 0.27 | 160HV |
| Ni | 1452 | 6.99 | 1.7 | 120HV |
| silicon | 1420 | $2.3\times10^{3}$ | 0.71 | 9630MPa |
| Pb | 327 | 22 | 0.13 | 38MPa |
| Pt | 1768 | 10.6 | 0.15 | 40HV |
| Boron | 2076 | 1.5×104 | 1.106 | 49000MPa |
| Ti | 1795 | 42 | 0.521 | 970MPa |
| V | 1910 | $2\times10^{-7}$ | 0.49 | 628MPa |
| Stainless steel | 1430-1500 | 69 | 0.468 | 255HV |
| W | 3000 | 5.6 | 0.133 | 3430MPa |
| Zn | 419 | 5.9 | 0.389 | 30HV |
| Manganin | 549 | 48.2 | 0.41 | 180HV |
| Constantan | 1230-1290 | 49 | 0.41 | 135HV |
| Chromel | 1427 | 70 | 3.2 | 1000 |
| NiCr | 1400 | 110 | 0.5 | 200Hv |
| Alumel | 1399 | 177 | 0.475 | 155HV |
| Ge | 938 | 0.46 | 0.31 | 8012MPa |
| Hf | 2227 | 33.1 | 0.144 | 1760MPa |
| Fe | 1530 | 9.7 | 0.462 | 608MPa |
| Li | 180 | 9.28 | 3.58 | 5MPa |
| Teflon | 327 | $10^{23}$ to $10^{25}$ | 1.05 | 50HV |
| Fused Quartz | 1700 | $7.5\times10^{17}$ | 1.1 | 580 KHN100 |
| Glass | 1400-1600 | $10^{11}$ to $10^{15}$ | 0.792 | 580 HV |
| Nayoro28A | 925 | 12.1 | 0.689 | 175HK |
| Nayoro G | 950 | 14.5 | 0.688 | 310HK |
| Nayoro K | 870-1000 | 16 | 0.6 | 265HK |
| Paliney 5 | 926 | 17.4 | 0.3 | 298HK |
| Paliney 6 | 1371 | 30.7 | 0.2 | 210HK |
| Paliney 7 | 1015 | 34.9 | 0.29 | 230HK |
| Paliney 8 | 970 | 29.9 | 0.33 | 230HK |
| Paliney 9 | 1065 | 36.6 | 0.4 | 308HK |
| Paliney 1100 | 97 | 37.5 | 0.26 | 360HK |
| Deriney72 | 1555 | 49.3 | 0.36 | 530HK |
| Paliney 25 | 1090 | 6.3 | 0.65 | 400HK |
| Paliney C | 90-162 | 10.1 | 0.23 | 350HK |
| Ney 75 | 11 | 2.3 | 0.31 | 112HK |
| Paliney H3C | 93-167 | 12.3 | 0.25 | 470HK |
| Paliney2000 | 78-140 | 12.8 | 0.12 | 325HK |
| Iridium | 2466 | 47.1 | 0.13 | 1760MPa |
| Cr | 1615 | 12.5 | 0.4 | 800HV |
| Mn | 1260 | 144 | 0.479 | 500HV |

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