

4. Conclusion

Tungsten carbide is synthesised from the mix of pure tungsten and carbon black with plasmadynamic method using the system based on the coaxial magnetoplasma accelerator. The plasmadynamic synthesis product is composed of tungsten W, tungsten carbides W_2C and WC_{1-x} and graphite gC. The main phase of the synthesized product is cubic tungsten carbide WC_{1-x} (more than 95%). Particles of tungsten carbide WC_{1-x} are sized up to 120 nm.

References:

1. Ming-Hong Lin. Synthesis of nanophase tungsten carbide by electrical discharge machining. *Ceramics International*. 2005. № 31. P. 1109-1115.
2. Harjinder Singh, O. P. Pandey. Single step synthesis of tungsten carbide (C) nanoparticles from scheelite ore. *Ceramics International*. 2013. № 39. P. 6703-6706.
3. S. Aravinth, Binu Sankar, M. Kamaraj, S. R. Chakravarthy, R. Sarathi. Synthesis and characterization of hexagonal nano tungsten carbide powder using multi walled carbon nanotubes. *International Journal of Refractory Metals and Hard Materials*. 2012. № 33. P. 53-57.
4. A.A. Sivkov, E.P. Naiden, D.Y. Gerasimov. Direct Dynamic Synthesis of Nanodispersed Titanium Nitride in a High-Speed Pulse Electroerosion Plasma Jet. *Journal of Superhard Materials*. 2008. № 30. P. 311-316.
5. A.A. Sivkov, D.S. Nikitin, A.Y. Pak, I.A. Rakhmatullin. Direct plasmadynamic synthesis of ultradisperse silicon carbide. *Tech Phys Lett*. 2013. № 39. P. 105-107.

Научн. рук.: Сивков А.А., д.т.н., проф. каф. ЭПП.

Shoretz, J.J.

WiTricity – Wireless Electricity

National Research Tomsk Polytechnic University.

What is WiTricity ?

- WiTricity is nothing but Wireless elecTricity.
- Transmission of electrical energy or power from one object to another without the use of wires is called as WiTricity.
- Because of WiTricity some of the devices won't require batteries to operate.

History of Wireless Power.

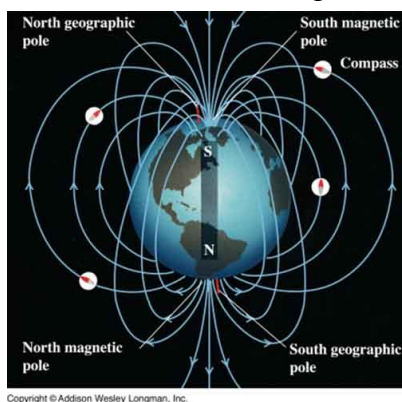
- In 1891, Nikola Tesla Proposed a method of Wireless Power Transmission. As it is in Radiative mode, most of the Power was wasted and has less efficiency.
- In 2005, Dave Gerding coined the term WiTricity which is being used today.
- Forgotten invention was reborn in 2007 by the MIT researchers.

Basics of WiTricity.

Electricity: The flow of electrons (current) through a conductor (like a wire), or charges through the atmosphere (like lightning).

Magnetism: A fundamental force of nature, which causes certain types of materials to attract or repel each other.

Electromagnetic Inductions: Is the production of voltage (induced current) across a conductor moving through a



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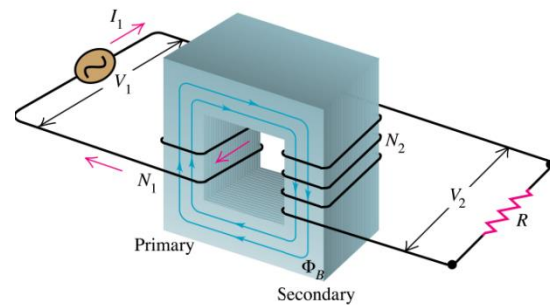
magnetic field. For example, it turns out that an oscillating magnetic field produces an electric field and an oscillating electric field produces a magnetic field.

Electromagnetism Energy: A term for the interdependence of time-varying electric and magnetic fields.

Power Coupling: It occurs when an energy source has a means of transferring energy to another object.

Resonance: Is the tendency of a system to oscillate with larger amplitude at some frequencies than at others. These are known as the system's resonance frequencies.

Resonant Magnetic Coupling: Magnetic coupling occurs when two objects exchange energy through their varying or oscillating magnetic fields. Resonant coupling occurs when the natural frequencies of the two objects are approximately the same.



WiTricity Technology.

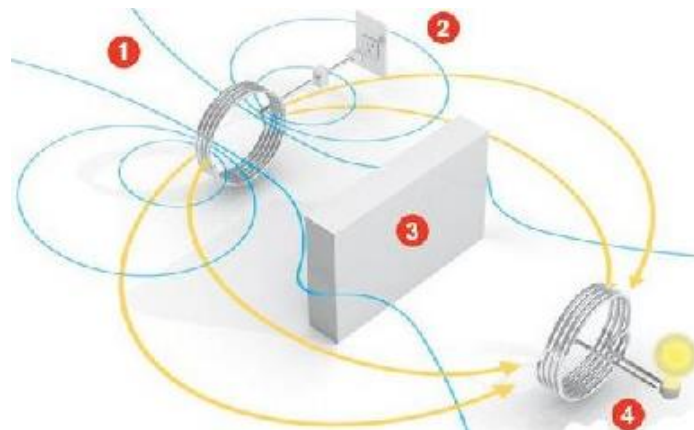
- There is WiTricity power sources (transmitter) and capture devices (receiver).
- Power source provides power to the devices where as capture device received it to work.
- Power source and capture devices are specially designed magnetic resonators.
- Magnetic resonators efficiently transfer power over large distance via the magnetic near-field.

Diagram Of Power Source And Capture Device.

Invention Of WiTricity.

Coupled resonators.

- Two resonant objects of the same resonant frequency tend to exchange energy.
- It exchange energy strongly, while interacting weakly with living beings and other environmental objects.
- Coupled resonators are said to be operate in strongly coupled regime to avoid material absorption and radiative loss.

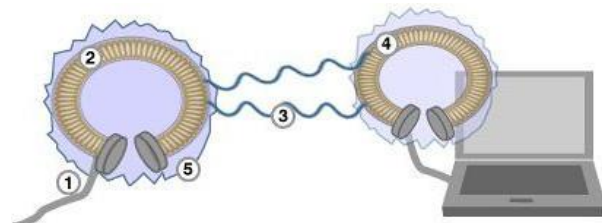


Strong coupling.

- The rate of energy transfer is significantly higher than rate of energy lose.
- Energy transfer is very efficient.
- Strength of interaction is very high.

How WiTricity Could Work?

1. Power from mains to antenna, which is made of copper.
2. Antenna resonates at a frequency of 10MHz, emitting electromagnetic waves.
3. 'Tails' of energy from antenna 'tunnel' up to 2.5m (8.2ft).
4. Electricity picked up by laptop's antenna, which must also be resonating at 10MHz. Energy used to re-charge device.
5. Energy not transferred to laptop re-absorbed by source antenna. People/other objects not affected as not resonating at 10MHz.



WiTricity Technology Can Provide.

1. Direct wireless power : when all the power a device needs is provided wirelessly, and no batteries are required. This mode is for a device that is always used within range of its WiTricity power source.
2. Automatic wireless charging : when a device with rechargeable batteries charges itself while still in use or at rest, without requiring a power cord or battery replacement. This mode is for a mobile device that may be used both in and out of range of its WiTricity power source.

WiTricity Applications.

- 1) Consumer Electronics: automatic wireless charging of mobile electronics (phones, laptops, game controllers, etc.)in home, car, office.
- 2) Industrial: direct wireless power and communication interconnections at points of use in harsh environment (drilling, mining, underwater, etc.).
- 3) Transportation: automatic wireless charging for existing electric vehicle classes: golf carts, industrial vehicles.

Conclusion.

- The transmission of power without wires is not a theory or a mere possibility, it is now a reality. The electrical energy can be economically transmitted without wires to any distance.
- Wireless transmission of electricity have many merits like high transmission integrity and Low Loss (more than 90% efficient) and can be transmitted to any where in the globe and eliminate the need for an inefficient, costly, and capital intensive grid of cables, towers, and substations.
- The system would reduce the cost of electrical energy used by the consumer and get rid of the landscape of wires, cables, and transmission towers.
- It has negligible demerits like reactive power which was found insignificant and biologically compatible. It has a tremendous economic impact to human society.

Finally.

Now you can Imagine the future in which wireless electricity makes everyday products more convenient, reliable, environmentally friendly and safe electricity I think the world will be change and you can say goodbye wires.

References:

1. Wireless Power Transfer via Strongly // Science.
2. Kurs, Andre. Coupled Magnetic Resonances // Science 317, 83 (2007); Doi:10.1126 / Science. 1143254, (2009).
3. Karalis, Aristeidies; Soljacic, Marlin. Efficient Non-Radiative Midrange Energy Transfer.
4. IEEE Spectrum.
5. www.WiTricity.com.
6. <http://www.WiTricitypower.com>.
7. <http://www.sciencemag.org/cgi/data/1143254/DC1/1>.
8. <http://www.sciencemag.org/cgi/content/abstract/1143254>.
9. <http://www.breakingnewsenglish.com/0706/070613-WiTricity.htm>.