Piezoelectricity-induced Room Temperature Superconductor

Navy Case PAX 263

(b) (6)
Department of Defense / Department of the Navy,
Naval Air Systems Command / NAWCAD,
NAS Patuxent River Maryland 20670;
E-mail: (b) (6) @navy.mil;
(b) (6) @yahoo.com
Competency Code: 4.3.5.1 Tel. 301-342-(b) (6)

Co-Inventors and Technical Paper

- Sole Inventor
- **Fundamental Innovative Principle**: The enablement of macroscopic quantum coherence induced by controlled motion of electrically charged matter under rapid acceleration transients. This principle can induce Room Temperature Superconductivity (RTSC), under certain conditions.
- Please refer to the imbedded invention-descriptive Technical Paper (double-click PDF icon below – Concept Drawing on page 14):

PAX 263 – 'Piezoelectricity-induced Room Temperature Superconductor'- S.C.PAIS

PDF

Piezoelectricity-in
ed Room Tempera

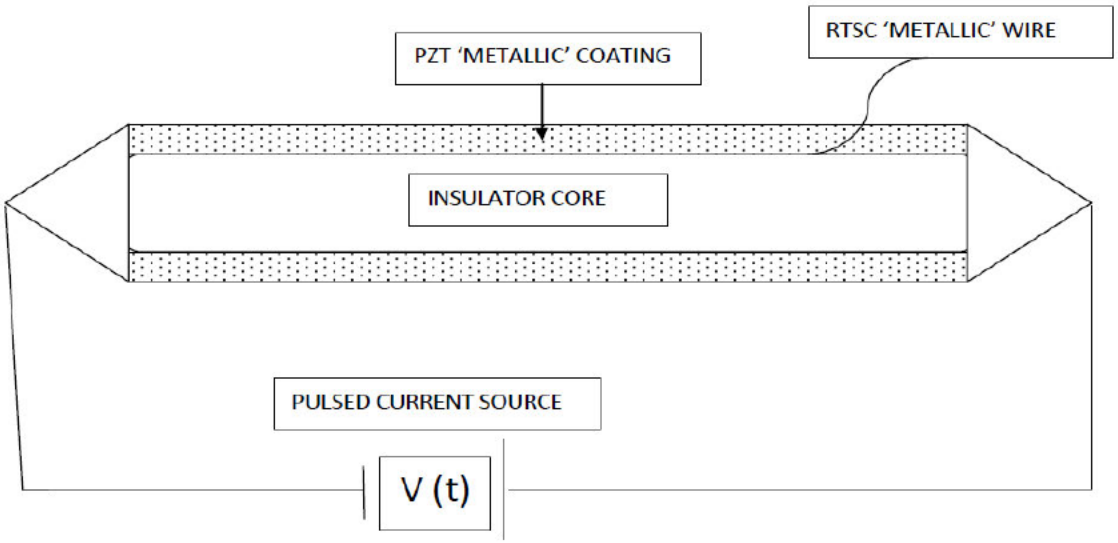

FIGURE 1 - CROSS-SECTIONAL VIEW OF RTSC WIRE

Background

- **SUPERCONDUCTIVITY SHOULD NOT EXIST - BUT IT DOES.**
- The achievement of **room temperature superconductivity (RTSC)** represents a highly disruptive technology, capable of a total paradigm change in Science and Technology, rather than just a paradigm shift. Hence its military and commercial value is considerable.

- It is important to realize that internal heating within any system enclosure can be greatly reduced by room temperature (300 deg. Kelvin and higher) superconducting wiring, which would allow for lossless transmission of electrical power to its subsystems.

- There are three parameters which affect superconductivity, namely temperature, current density, and externally applied magnetic field strength. Physically, these parameters have in common one thing, that is, the interactive motion of electric charges, namely electrons.

- Control of this motion via vibration and/or spin of electrically charged matter subjected to rapid acceleration transients (highly non-linear in nature) may lead to the achievement of room temperature superconductivity, especially if the charged matter is inhomogeneous.

- At the present time, it is believed that the mechanism of superconductivity can be induced either by bipolaron formation or Cooper pairing (attraction between electrons). The important realization is that independent of physical mechanism, the key to observed superconductivity is the strong electron-lattice (phonon) coupling. **Strong electron-lattice interactions (non-linear electron-phonon coupling) can be obtained from abrupt / accelerated vibration of a wire, thereby providing justification for our argument on the possibility of RTSC enablement.**

Description of Invention

- **POSSIBLY**, all you need to do in order to make a special composite metallic wire be superconductive (SC) at room temperature, is to make it abruptly vibrate, while running a pulsed current through it, just like 'plucking' a guitar string, intermittently. The current must be pulsed for maximum effect.
- The special composite metal wire is composed of a bulk (core) insulator (such as Teflon, or any other non-conductive polymer) with a 'thin' coating of a normal or poor metal (such as Aluminum or lead zirconate titanate (PZT) ceramic), of a thickness on the order of the London penetration depth (but possibly much thicker, based on experiments to be performed), given an externally applied magnetic field. Arguably, this wire configuration may be termed an unconventional superconductor, since the RTSC supercurrent may be generated along the interface (boundary) between the normal metal and the insulator portions of the wire. This is due to the abrupt change in state between the normal metal portion of the wire and the insulator section, analogous to an abrupt phase transition occurring along the metal/insulator interface, which spontaneously breaks symmetry and thereby induces superconductivity. This abrupt change in state (phase transition) occurs as the wire is abruptly vibrated and occurs at the boundary between the metal and the insulator portions of the wire, as various states of charged (metallic) and non-charged (insulator) matter are thrown into a state of coherent superposition.

- **Invention was conceived on 02/01/2017 – no prototype in existence, as yet.**

Potential Uses

- What is the Navy's potential use for this invention
- The Piezoelectricity-induced Room Temperature Superconductor can be used in a variety of applications ranging from transmission of electrical power with no losses, the manufacture of miniaturized electromagnetic generators and transformers, to the design of extremely high Magnetic Field generators (which feature persistent currents).
- Is there the potential for commercial use – **YES**
- The design of miniaturized electromagnetic generators and transformers.
- The design of high Magnetic Field generators for medical imaging, etc.

- **<u>The possible enablement of Macroscopic Quantum Coherence.</u>**

- The key to room temperature superconductivity is the enablement of local macroscopic quantum coherence, namely the ability of a macroscopic object to act as if quantum mechanical in nature exhibiting such phenomena as superposition, entanglement, tunneling.
- It is a well-known facet of quantum field theory that everything can be described in quantum mechanical terms. The complex interactions between a physical system and its surroundings (environment), disrupt the quantum mechanical nature of a system and render it classical under ordinary observation. This process is known as decoherence.
- However, it is argued that we can delay decoherence (and possibly even suppress it - namely decouple a physical system from the environment) by accelerated spin and/or accelerated vibration of electrically charged matter under rapid acceleration transients. This may be the very condition to achieve a state of macroscopic quantum coherence, the idea being that we never let the system achieve thermodynamic equilibrium, by constantly delaying the onset of relaxation to equilibrium (hence the production of maximal entropy is delayed).
- The system may 'violently' react by generating "anomalous" emergent phenomena, such as, but not limited to, **ROOM TEMPERATURE SUPERCONDUCTIVITY**.

Costs

- What is the Navy's (future) investment (FY19) in the invention.

EXPERIMENT TRUMPS THEORY EVERYTIME !

  - this is a theoretical concept – no prototype in existence, as yet (Section 219 NISE funding for experimental investigation may be requested for a 4.3.5.1 envisioned experiment).
  - Anticipated NAWCAD facility cost (rough estimate) – 200K USD (labor plus materiel – possibly spread over two years).
  - Estimated cost of any outside sources (i.e., drawings, labs, facilities) N/A
  - Current work on NISE FY17 BAR project 219BAR-17-009 'The High Energy Electromagnetic Field Generator' (HEEMFG) test feasibility study, may help with design criteria and requirements for this experiment.

  - Are there potential cost savings to the Navy. - **YES**
  - If yes, what is/are the potential cost savings to the Navy.

The inventive concept (which may represent a revolutionary technology) does reveal a novel, effective and expedient manner of ensuring the Battlespace Supremacy of the United States Warfighter for generations to come, thus addressing an urgent national and international area of concern, of primary national security importance.

Therefore its potential cost savings to the Navy are incalculably great, with respect to innumerable lives and assets saved, not to mention the great commercial benefits of achieving **Room Temperature Superconductivity**.

Concluding Remarks: Dimensional analysis of the fine structure constant (ratio of the electromagnetic force to the strong nuclear force) results in the notion that **it is the paired electric charge and its bound interactive motion within the quantum vacuum that is fundamental to the nature of our Cosmos.** Therefore, by controlling this motion, numerous advancements in Science and Technology may arise, **Room Temperature Superconductivity** being one such advance.