Novel Guitar Pickups

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Abstract: To produce sound, an electric guitar senses the vibrations of the strings electronically and routes an electronic signal to an amplifier and speaker. The sensing occurs in a magnetic pickup mounted under the strings on the guitar's body. This pickup consists of a bar magnet wrapped with as many as 7,000 turns of fine wire. Magnetic pickups have gotten a bad reputation over the years. They tend to have a warm full low end sound but are sometimes overly bright and loud, on the 1st and 2nd strings. There's a simple explanation. A magnetic pickup senses, or reads, the steel in a guitar string. The part of the guitar string that is steel in a wound acoustic guitar string is the core. Even though the overall size of a wound string is bigger than a plain string, the steel part of the wound string is smaller. So you end up with an unbalanced sound. There have also been a case in which a guitars top was cracked by the weight of the pickup when an airplane dropped from turbulence .To overcome this trouble the bar magnet used could be replaced by graphene in the form of thin layers which will reduce the size of pickup considerably and also increases the balance of sounds at various parts of the steel string.

Index Terms: graphene, guitar pickups, nanoscience, scanning tunnelling microscope (STM), tetracyano-p-quinodimethane (TCNQ), transducers ,vacuum chamber.

1 Introduction

Pickups are transducers that convert the mechanical energy of a vibrating guitar string into electrical energy by way of electromagnetic induction which states that changing magnetic field will generate a current through a coil of wire. The electric guitar pickup uses permanent magnets and pole pieces to form a steady magnetic field in the vicinity of each individual guitar string. An opposite magnetic polarity is induced in the metallic (steel core) guitar string when mounted above its respective pole piece and when the string moves, the otherwise steady magnetic field changes accordingly. Wire is wrapped around the poles thousands of times to form a coil within the magnetic field to pick up an induced current and voltage. The output signal from the pickups is AC (alternating current) because the direction of the current alternates, producing a positive voltage when the string moves in one direction and a negative voltage when the string moves in the opposite direction.

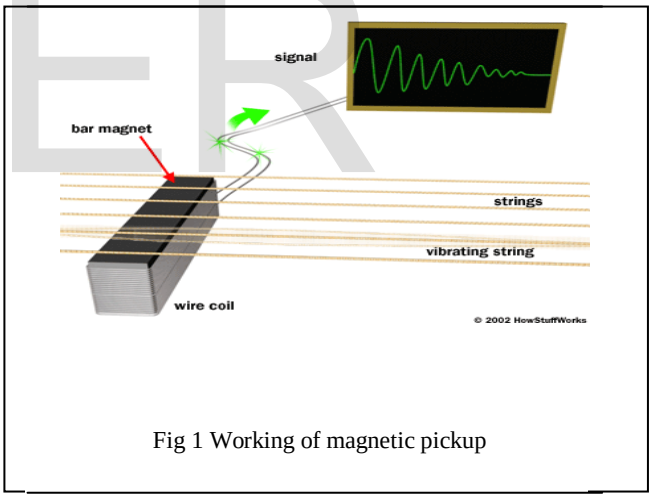

Fig 1 Working of magnetic pickup

2 Magnetic Property Of Graphene

In order for a material to be have magnetic properties a majority of the electrons in the material must be spinning in the same direction. The technique involves growing an ultra perfect grapheme film over a ruthenium single crystal inside an ultra high vacuum chamber whereorganic molecules of tetracyano-p-quinodimethane (TCNQ) are evaporated on the grapheme surface. TCNQ is a molecule that acts as a semiconductor at very low temperatures in certain compounds.On observing results through an scanning tunnelling microscope (STM), scientists were surprised: organic molecules had organised themselves and were regularly distributed all over the surface, interacting electronically with the graphene-ruthenium substrate."We have proved in experiments how the structure of the TCNQ molecules over graphene acquires long-range magnetic order, with electrons positioned in different bands according to their spin," clarifies Prof. Amadeo L.

Vázquez de Parga. Modelling studies were conducted that have shown that, although graphene does not interact directly with the TCNQ, it does permit a highly efficient charge transfer between the substrate and the TCNQ molecules and allows the molecules to develop long range magnetic order.

control. All these little improvements might make the amplifier output sound less 'larsen'.

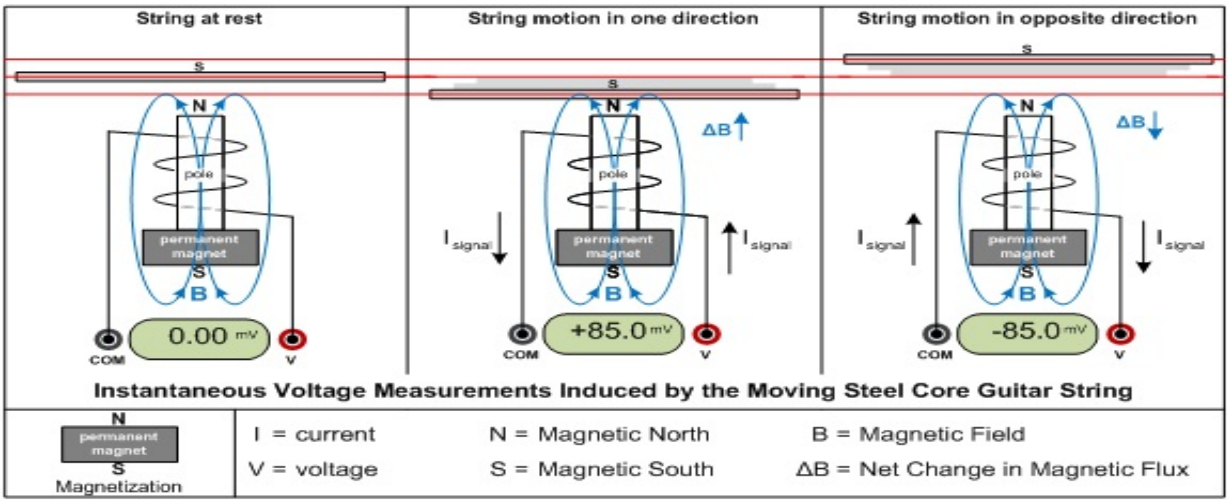

Fig 2 Various positions of strings during motion

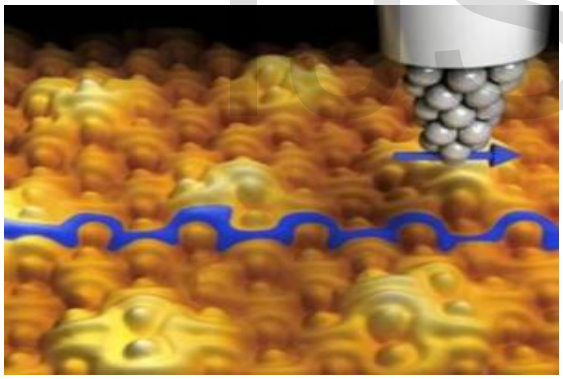

Fig. 3 Computerised simulation of TCNQ molecules on graphene layer, where they acquire a magnetic order. (Credit: IMDEA-Nanoscience)

3 Conclusion

When graphene is used to produce the magnetic field to produce electrical signals through electromagnetic induction the weight of the device gets largely reduced which in turn reduces the pressure exerted on the strings. This might also provide considerable improvements by not tending to lose the extremes of low and high frequencies and produce more dynamic.

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