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DESIGN AND TECHNICAL SOLUTION OF A SPECIAL MOTOR WITH PERMANENT MAGNETS

PROJEKT I ROZWIĄZANIE TECHNICZNE SPECJALNEGO SILNIKA Z MAGNESAMI TRWAŁYMI

Abstract: Described in the paper is a new design and technical solution of the Permanent Magnet Motor for easy low power applications. Currently, known are different technical solutions for electric motors that use magnetic and electromagnetic fields. The magnetic motor works only on the basis of repulsion of permanent magnets. The basis of the technical solution is use of auxiliary magnets. Auxiliary magnets axially move the main drive magnets so that the rotor can be continuously rotated in defined direction. The hereto paper presents initial results of the construction design and calculated waveforms of magnetic motor with permanent magnets.

Streszczenie: W artykule przedstawiono nową konstrukcję i rozwiązanie techniczne silnika z magnesami trwałymi małej mocy do zastosowania w prostych aplikacjach. Obecnie znane są różne rozwiązania techniczne silników elektrycznych, które korzystają z pól magnetycznych i elektromagnetycznych. Silnik magnetyczny działa tylko na podstawie odpychania magnesów trwałych. Podstawą rozwiązania technicznego jest zastosowanie magnesów pomocniczych. Magnesy pomocnicze przemieszczają osiowo główne magnesy dysku tak, że wirnik może w sposób ciągły obracać się w określonym kierunku. Przedstawiono wstępne wyniki projektu budowlanego i obliczone przebiegi silnika magnetycznego z magnesami trwałymi.

Keywords: *magnetic motor, permanent magnet, design*
Słowa kluczowe: *silnik magnetyczny, magnes trwały, projekt*

1. Introduction

With greater demand of energy fossil fuels are rapidly depleting and renewable energy is becoming the alternate solution to the energy deficiency. Research is going on to find better ways to generate more sustainable energy. There are many motives for renewable energy. In one form or the other such schemes involve the use of magnetic machines.

Most people believe that the magnetic motor will never become a reality. But many ideas that have previously been regarded as unrealistic are undoubted today. Presently, development of technology has such a rapid pace, that what today cannot be made, in the future will become a possibility, and will be commonly used.

Nowadays, scientists say the universe is 60% “Radiant/Dark” energy, which we cannot use at today's level of knowledge. Engineers of Hitachi Magnetics Corp. of California have stated that a motor-generator run solely by magnets is feasible and logical but the politics of the matter make it impossible for them to pursue developing a magnet motor or any device that would compete with the energy cartels [1].

Currently, known are different technical solutions for electric motors that use magnetic and electromagnetic fields. Many opponents of the magnetic motor maintain that the operation of such a machine contradicts the laws of physics. But all laws apply to the particular degree of knowledge and we cannot rely on just one law - that the law of energy conservation, because in the nature (and hence the macrocosm and microcosm) existent are laws eluding our level of technology and knowledge. Another frequent argument of opponents is that such equipment is presently industrially unusable.

But the question is whether the device would be usable in the near future (if not on Earth, for example in space technology, where there are different laws). In current practice of technology development proceeds so fast that what a few years ago seemed to be impossible is now is commonly used. We can find a lot of patents that have found applications only several decades later.

What today seems to be unrealistic and is contrary to the current laws of physics could be a reality in a few years. One example is the

NASA Futuristic EM Drive [2]. A group at NASA's Johnson Space Center has successfully tested an electromagnetic (EM) propulsion drive in a vacuum – a major breakthrough for a multi-year international effort comprising several competing research teams. Thrust measurements of the EM Drive exceeded classical physics' expectations. A group encouraged by these results, NASA Eagle-works plans to test it in a vacuum.

2. Current designs of magnetic motors

In the world today many patents and applications for industrial designs of the magnetic motor are filed. Also, many technical solutions of the magnetic motor use only permanent magnets and repulsive and attractive forces between magnets. I will mention only a several of the best known of the published solutions.

The best known is the Perendev Motor [3]. Perendev says it works by using the power of neodymium to propel itself. The construction of Perendev motor is relatively simple but no one succeeded in making such a replica of the motor that could be rotated without interruption. The replica always rotates only for a while, and then additional external force must be added to maintain rotation. Inventor Achilles Ligeras claims to have built a working prototype of Magnetic Engine (ALME) driven solely by magnets, with no additional input [4]. The first working prototype achieved rotation speed of approximately 1500 rpm for fifteen minutes, and was running continuously at a lower speed for about 48 hours. A second, more professionally machined prototype was completed but, unfortunately, that one did not work. Bowman motor with permanent magnets consists of three parallel shafts geared together so that the central one turned in opposite direction to the two outside shafts [5]. At the ends of the shafts attached were three discs (on the centre shaft one large disc and on the end of the outside shafts two small ones). The discs contained small AlNiCo magnets, eight of them spaced around the large disc, and four around each of the small discs (equally spaced). The motor rotated at a speed of almost half revolution per second of the side shafts. Many enthusiasts wanted to build this motor, but so far neither of them did work reliably. David Hamel magnetic motor (the "3 cone device" or "3CD") is in perpetual motion via 3-body interaction physics to the zero point energy fields via the use of duality – magnetism, and of vibration [6]. Chaos physics induced through 3-body interactions and to provide conditions of acceleration in the apparatus. Describing all the constructions of magnetic motors would be very lengthy, and hence above mentioned are only the best known ones.

3. Technical solution and construction of magnetic motor

The Magnet motor works only on the principle of powerful neodymium permanent magnets. Having accurate information on how to construct a magnetic motor is really important. Precisely defined must be how the magnets are to be placed so that most advantageous movement is achieved. The magnets will operate in a rhythmic manner by repelling each other. Because of this movement, this machine is capable of generating mechanical torque. The size of torque produced is directly proportional to the size of the magnets, meaning the bigger the magnets the more torque they produce. The disadvantage of all existing technical solutions of the magnetic motor is its relatively complicated construction, mechanical losses and often also high price. The above mentioned disadvantages are considerably eliminated by the self-magnetic energy source (SAMZEN) – a magnetic motor of new construction. Materials needed to build the magnetic motor are easily obtainable. Figure 1 illustrates the schematic developed cut of the magnetic circuit of magnetic motor across mean diameter of the main and flip permanent magnets.

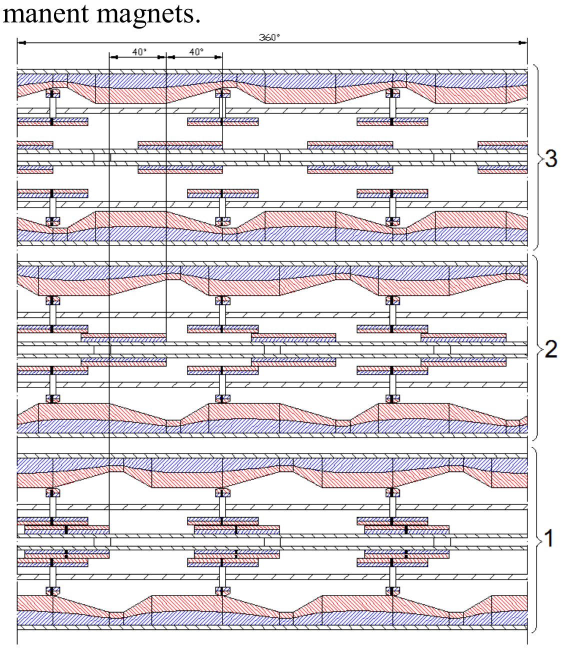

Fig. 1. Schematic developed cut of the magnetic circuit motor

The basis of the technical solution of the magnetic motor is that the motor is made of three main identical parts (Fig. 1 – parts 1, 2 and 3) that are stored one above the other. Three main identical parts of the rotor are mutually shifted by 40° angle (Fig. 1). For the functionality of the engine very important is the change of the mutual distance among the main magnets of rotor and stator. This is accomplished by auxiliary (flip) magnets and of flip mechanism. The flip mechanism is described hereafter.

Each base part of the magnetic motor consists of two stators and two rotors. The rotors and stators are disc-shaped. All rotors are connected to a single shaft. Present on every rotor there are three main magnets and one flip magnet having the form of a circular ring with a precisely defined but varying thickness (Fig. 2). The rotor main magnet and flip magnet are mutually moved by 30° angle (Fig. 2).

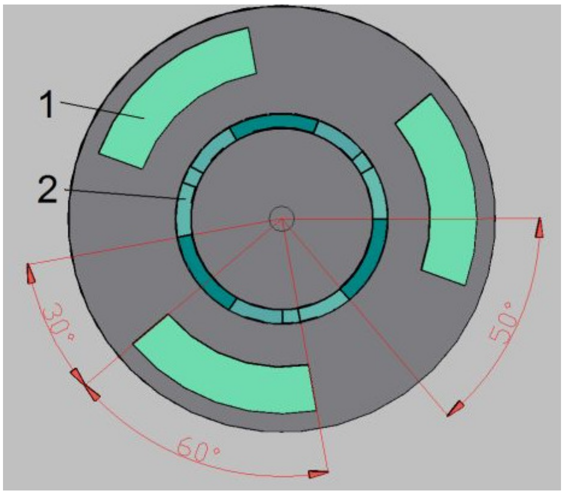

Fig. 2. View of part rotor with magnets

The rotor main magnets (Fig. 2 – 1) have a sector of a circle with angle of 60° and width of 25 mm. The rotors are in the individual parts of the motor (1 to 3) shifted relative to each other by 40° (Fig. 1).

Very important is the geometric shape of the flip magnet (Fig. 2 – 2). Flip magnet with an auxiliary spring continuously sets the distance between the main stator and rotor magnets in individual parts of the motor. Without this, the motor operation is not possible. Important is also the remanence (Br) of the flip magnet. The detailed construction and shape of flip magnet is shown in figure 3.

The rotor flip magnet has three sectors of a circle with angle of 50° and with maximum height. Minimum height is on three sectors of a circle with angle of 10°. Between those sectors is the run-in and lead-out section with 30°angles (Fig. 3). On those sectors the flip magnet has a different remanence.

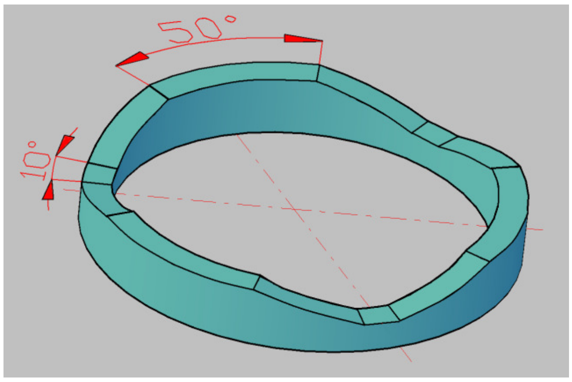

Fig. 3. Construction and shape of flip magnet

Figures 4 and 5 illustrate the schematic model of one part rotor. The magnetic motor has three identical rotors on one shaft mutually shifted by precisely defined angle (40°).

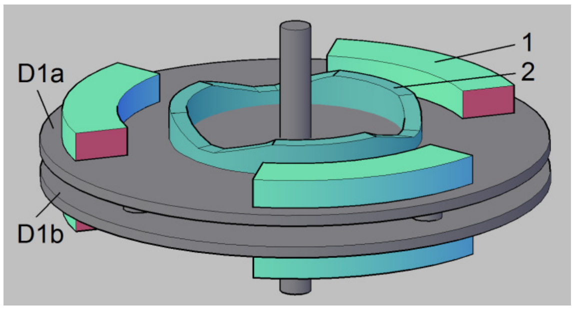

Fig. 4. 3D-view of one part rotor with magnets

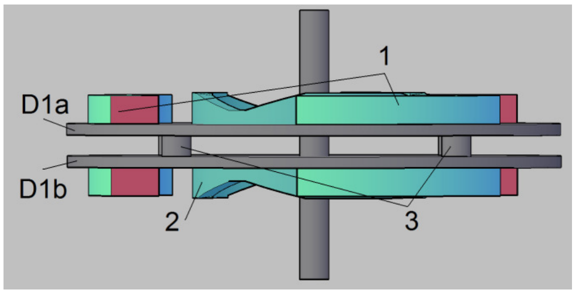

Fig. 5. A side view of one part rotor with magnets

One part of rotor consists of two un-magnetic disks (e.g. brass) - D1a and D1b with magnets (main magnets – 1, flip magnet – 2) fixed to it (Fig. 4 and 5). The rotor disks are rigidly engaged (3 – Fig. 5). The shaft (with three mutually shifted main identical parts of rotor) rotates in ceramic or magnetic bearings (Fig. 7).

The main stator magnets have a sector of a circle with angle of 50° and width of 20 mm. The number of stator main magnets is three (Fig. 6).

Each stator main magnet is placed on a separate flip mechanism. Three flip mechanisms on one stator are mutually moved by 120°.

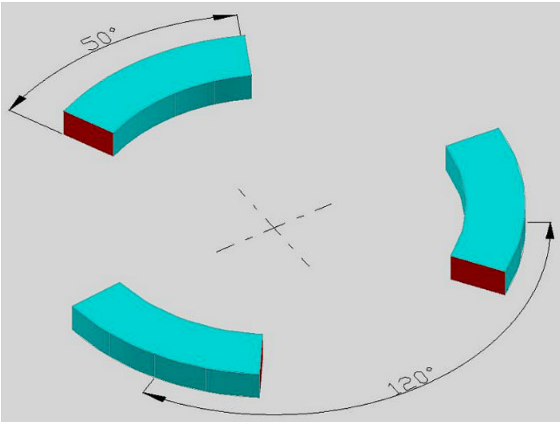

Fig. 6. View of main stator magnets

Each flip mechanism has on the reverse side (nearer to the shaft) an auxiliary flip magnet fixed to it. Shape and dimensions of auxiliary stator flip magnets depend on the rotor flip magnet. The auxiliary flip magnets have a sector of a circle with angle of 10° and width of the rotor flip magnet (Fig. 7).

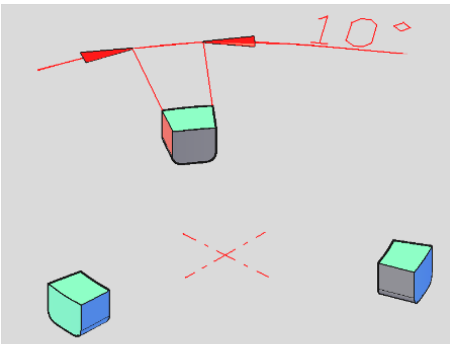

Fig. 7. View of auxiliary flip magnets

The overall construction of the magnetic motor is shown in figure 8. It contains three parts, one above the other, but the magnets on rotors of different parts are shifted relative to each other by 40°. Stator main magnet is fixed on a separate flip mechanism. As a result, different is the distance between the main stator and rotor magnets in individual parts of the motor (Fig. 8).

To eliminate mechanical losses the motor shaft is mounted in ceramic or magnetic bearings. On the bottom end of the shaft there is a magnet that acts against the gravity force of the rotor. This magnet also serves as a flywheel.

Detailed construction of the flip mechanism is shown in figure 9.

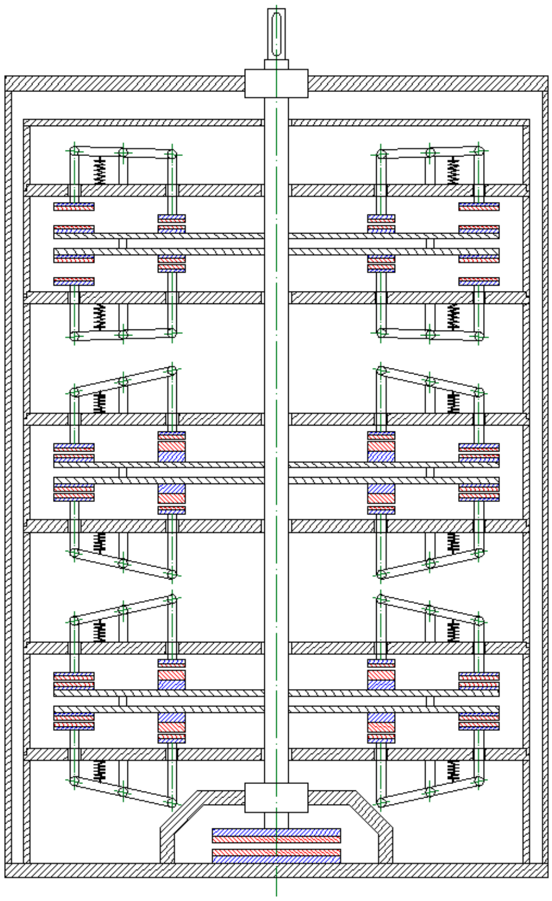

Fig. 8. Design of construction magnetic motor

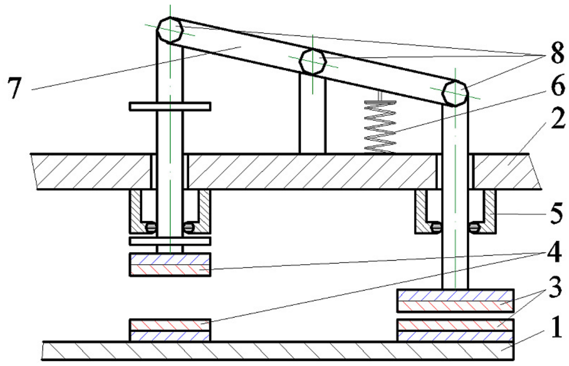

Fig. 9. Construction of flip mechanism

Description of flip mechanism in Figure 6: 1 – the rotor disk, 2 – the stator disk, 3 – main stator and rotor magnets, 4 – flip magnets on rotor and stator, 5 – rod guiding, 6 – spring, 7 – connecting rod, 8 – ceramic bearings.

4. Calculation of forces in magnetic motor

Flip mechanism continuously sets the distance between the main stator and rotor magnets in individual parts of the magnetic motor. Figure 10 illustrates distribution of the forces in flip mechanism.

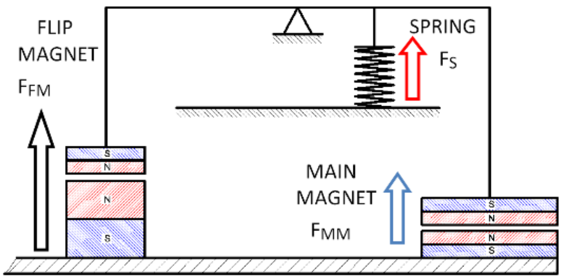

Fig. 10. Schematically illustrated forces - main magnets in minimal distance

The equation of forces in flip mechanism can be hence expressed as:

$$F_{MM}+F_S<F_{FM} \qquad (1)$$

where: F_{MM} is force of main magnets, F_S is force of the spring, and F_{FM} is force of flip magnets.

At a minimum distance of main magnets repulsive force of flip magnets acts against repulsive force of main magnets and against the force of the spring. Repulsive force of magnets, depending on their distance, decreases quadratically. The course of the spring force, depending on the compression, is linear (Fig. 11).

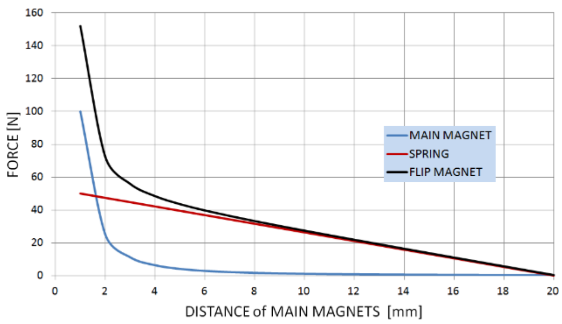

Fig. 11. Calculated waveforms of forces

Validity of equation (1) is achieved by variable thickness and variable remanence of flip magnet. E.g. at distance of the main magnets of 10 mm, the flip magnet overcomes only the force of spring. At a maximum distance of the main magnets (20 mm) the repulsive force is minimal, force of spring is zero and repulsive force of flip magnet can be minimal (Fig. 11and Fig. 12).

The force of spring can be adjusted by distance of the spring from the rotation axis of the connecting rod.

Figure 13 show the calculated forces of magnetic motor at the rotor rotation of 360° (one revolution). In the calculation used were the basic equations for determining the repulsion force of two magnets, and available literature ([8], [9], [10]).

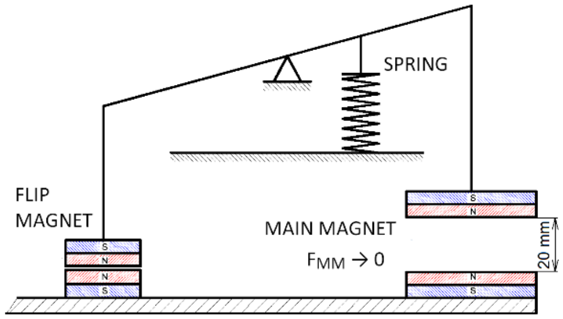

Fig. 12. Schematically illustrated - main magnets in maximal distance

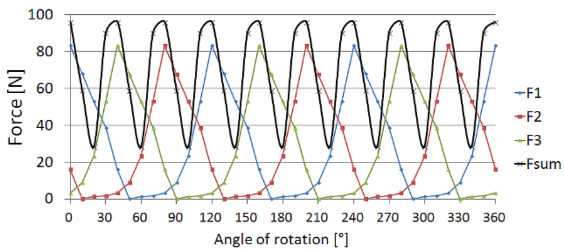

Fig. 13. Calculated forces of magnetic motor

Explanation for Fig. 13: F1, F2, F3 – particular forces for three main parts of the motor, Fsum – total force applied to the rotor.

For increasing the minimum value of total force changed is shape of flip magnet (Fig. 14).

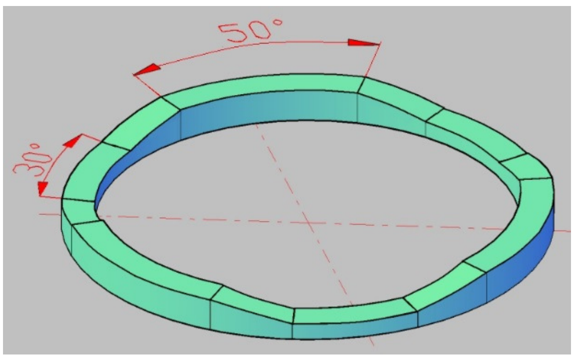

Fig. 14. Modified shape of flip magnet

Minimum height is on sectors of a circle with angle of 30° (This is modified), but maximum height was not modified (50°). Between those sectors are the run-in and lead-out sections with angles of 20° (Fig. 14).

Figure 15 shows calculated forces of the magnetic motor, where *F1* is particular force for three main parts of the motor before modification of flip magnet and *F1mod* is particular force after modification.

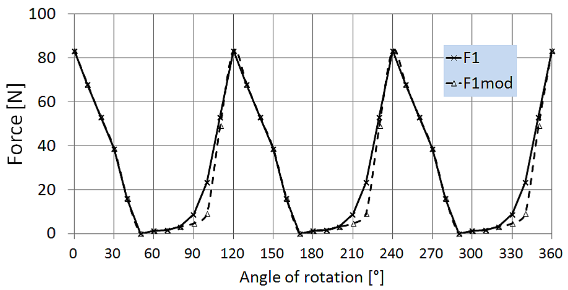

Fig. 15. Calculated particular forces of magnetic motor

Figure 16 shows the calculated total forces of magnetic motor applied to the rotor, where *Fsum* is total force before modification of flip magnet and *Fsum-Mod* is the total force after modification.

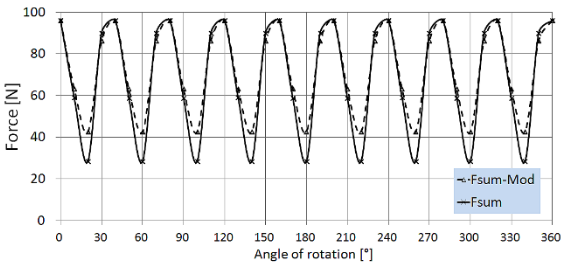

Fig. 16. Calculated total forces of magnetic motor

After modification of the flip magnet is minimum value of total force higher by approximately 50% but maximum value of total force is unchanged (Fig. 16).

5. Conclusion

The paper presents results of the construction, design and initial calculation forces of magnetic motor with permanent magnets. The magnetic motor will be subject to patenting process. This is the first construction design of fully magnetic motor. The design and calculation forces of the magnetic motor will be verified by simulation.
One more brief consideration on the future of permanent magnet motors:
The evidence suggests that use of permanent magnet motors will continue to grow as they are used in new applications. Innovations are in the area of high energy permanent magnets (PM). One of these innovations is the nano-composite permanent magnet. These magnets are “artificially" constructed magnetic structures (referred to as metamaterials) that produce strong permanent magnets by fabricating nanostructured hard/soft phase composite materials. Currently, they are being used in biomedicine, magnetic storage media, magnetic particle separation, sensors, catalysts and pigments. In the future, the world may see nanocomposite magnetic materials finding use in upcoming generations of PM electric motors [7].

6. Acknowledgment

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