Evaluation of Biofield Treatment on Physical, Atomic and Structural Characteristics of Manganese (II, III) Oxide

Mahendra Kumar Trivedi, Trivedi Global Inc.
Gopal Nayak, Trivedi Global Inc.
Shrikant Patil, Trivedi Global Inc.
Rama Mohan Tallapragada, Trivedi Global Inc.
Omprakash Latiyal, Trivedi Global Inc.
Evaluation of Biofield Treatment on Physical, Atomic and Structural Characteristics of Manganese (II, III) Oxide

Trivedi MK, Nayak G, Patil S*, Tallapragada RM and Latiyal O
Trivedi Global Inc., 10624 S Eastern Avenue Suite A-969, Henderson, NV 89052, USA

Abstract

In MnO₂, the crystal structure, dislocation density, particle size and spin of the electrons plays crucial role in modulating its magnetic properties. Present study investigates impact of Biofield treatment on physical and atomic properties of MnO₂. X-ray diffraction revealed the significant effect of biofield on lattice parameter, unit cell volume, molecular weight, crystallite sizes and densities of treated MnO₂. XRD analysis confirmed that crystallinity was enhanced and dislocation density was effectively reduced by 80%. FTIR spectroscopic analysis revealed that Mn-O bond strength was significantly altered by biofield treatment. Electronic spin resonance analysis showed higher g-factor of electron in treated MnO₂ as compared to control, along with altered spin-spin atomic interaction of Mn with other mixed valence states. Additionally, ESR study affirmed higher magnetization behaviour of the treated MnO₂. The results demonstrated that treated Mn3O4 ceramic could be used as an excellent material for fabrication of novel magnetic data storage devices.

Keywords: Biofield treatment; Mn₃O₄, X-ray diffraction; FT-IR; Paramagnetic; ESR; Brunauer-Emmett-Teller analysis; Particle size analysis

Introduction

Transition metal oxides (TMOs) constitute most interesting classes of solids, which exhibits different varieties of structures and properties [1]. Manganese (II, III) oxides (Mn₃O₄) is an excellent example of TMOs which gained significant attention among researchers due to its wide range of applications in magnetic materials, catalysis, ion exchange, magnetic data storage, super capacitors, molecular adsorption and ferrite materials [2-8]. MnO₂ shows a paramagnetic behaviour at room temperature and ferromagnetic below 41-43K. The magnetic properties of MnO₂ strongly depend on dislocations, vacancies, crystallite sizes, and lattice parameters. This affirms that crystal structure and its properties play an exclusive role in controlling magnetic strength in MnO₂ that can be exploited in magnetic data storage applications. MnO₂ exists as normal spinal crystal structure, in which Mn²⁺ occupy a tetrahedral position and Mn³⁺ at octahedral positions [3,4].

Recently, magnetism and electrochemical properties in MnO₂ nanoparticles are controlled by modulating the crystal structure by various processes such as annealing at high temperature [9], doping [10], hydrothermal [11], ultrasonic bath [12] and co-precipitation etc. Physical and chemical properties like particle size, surface area of MnO₂ nanoparticles are controlled by various methods including vapor phase growth [13], thermal decomposition, chemical liquid precipitation and solvothermal [14,15].

Nevertheless each technique has their own advantages but there are certain drawbacks which limit their applicability at commercial level, such as vapour deposition method required high pressure and temperature to produce highly crystalline powder whereas thermal decomposition method requires specialized surfactants which may cause impurities in the product [16]. It has been already reported that magnetic behaviour can be improved by increasing the crystallinity and particle size volume [9,16]. Hence in order to develop highly crystalline MnO₂ nanoparticles and to improve its applicability at commercial level a simple and cost effective method should be designed. Biofield treatment is an excellent and cost effective approach which was recently used to modulate the, atomic structure [17,18] and density [19-21] molecular weight [22,23] of the bound atom thereby it facilitates the conversion of energy into mass and vice versa. Mr Trivedi is known for utilizing his biofield, referred herein as biofield treatment, for conducting experiments in various sectors such as material science [17-24], agriculture [25-29] and microbiology [30-32], which are already reported elsewhere. Biofield treatment had significantly changed the physical, atomic and thermal properties in transition metals [17,18,20], carbon allotropes [19] and metal oxide ceramics [21,23] such as particle size was decreased by 71% in zirconium oxide [23] and crystallite size was increased by 66% in Vanadium Pentoxide (V₂O₅) [21]. Hence in present research investigation, MnO₂ powder was exposed to Mr. Trivedi’s biofield in order to improve its physical, structural, and magnetic properties. The treated Mn₃O₄ samples were characterized by FT-IR, XRD, ESR, Brunauer-Emmett-Teller (BET) analysis and particle size analysis.

Experimental

Manganese (II, III) oxide powders used in the present investigation were obtained from Sigma Aldrich, USA (97% in purity). Five sets of these metal oxide powders were prepared from the master sample, where first set was considered as control which was untouched (unexposed), other four samples were exposed to Mr. Trivedi’s biofield, referred herein as treated sample (T1, T2, T3, and T4). Particle size of control and treated samples were measured by laser particle size analyzer. SYMPATEC HELOS-BF, had a detection range of 0-42μm with setting parameters remain the same for all evaluations. The data obtained from particle size analyzer was in the form of a chart

*Corresponding author: Patil S, Trivedi Global Inc., 10624 S Eastern Avenue Suite A-969, Henderson, NV 89052, USA, Tel: +1 602-531-5400; E-mail: publication@trivedieffect.com

Received May 25, 2015; Accepted June 23, 2015; Published July 03, 2015

Citation: Trivedi MK, Nayak G, Patil S, Tallapragada RM, Latiyal O (2015) Evaluation of Biofield Treatment on Physical, Atomic and Structural Characteristics of Manganese (II, III) Oxide. J Material Sci Eng 4: 177. doi:10.4175/2169-0022.1000177

Copyright: © 2015 Trivedi MK, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Results and Discussions

Particle size and surface area analysis

The particle size determination of ceramic materials provides superior control over a range of product performance characteristics. The particle size of Mn$_3$O$_4$ was determined and illustrated in Figure 1. The average particle size ($d_{50}$) in treated sample was increased up to 13% and then further was decreased by 3%.

Contrarily particle size $d_{99}$ (size below which 99% particles present) was reduced by 5.5% in treated Mn$_3$O$_4$ samples. Surface area of the Mn$_3$O$_4$ was measured by using BET analysis, and results are presented in Figure 2 and Tables 2 and 3. The surface area of treated powders was reduced by 10% in 99 days after biofield treatment. Initially surface area were decreased by 4.5% with corresponding increase in particle size, however after 80 days both surface area and particle size were reduced. The particle size was increased initially, which was supported by a decrease in surface area due to the agglomeration of fine particles. Nevertheless a decrease in both particle size and surface area after 80 days indicate that coarse particles would have fractured into finer particles with sharp edges and corners.

X-ray diffraction (XRD)

Mn$_3$O$_4$ ceramic powder was subjected to XRD analysis to investigate its crystalline nature and Powder X software was used to calculate various atomic and structural parameters. The XRD diffractogram of control and treated Mn$_3$O$_4$ samples are illustrated in Figures 3a-3e. In the XRD diffractogram, only Mn$_3$O$_4$ phase appears with intense crystalline peaks (JCPDS Card No. 0041-1442) at Braggs angle 20 = 17.8°, 28.7°, 32.2°, 36°, 37.8 °, 44.2°, 50.4°, 58.2°, 59.6°, 64.6°, 73.8°. These crystalline peaks are attributed to plane (101), (112), (103), (211), (004), (220), (105), (321), (224), (400) and (413) respectively. The intensity of peaks increased in treated Mn$_3$O$_4$ samples along (103), (211), and (224) direction confirming increased crystallinity in treated samples Figures 3b-3e. This result indicates that biofield treatment is directly acting upon the ceramic crystals inducing more long range order; thereby facilitating crystallization of the ceramic samples.

Figure 4 shows that the lattice parameter was reduced in treated samples from 0.25% to -0.30% in time period of 16 to 147 days. It was found that reduction in lattice parameter caused reduction in volume of unit cell and increase in density (Figure 4). Additionally molecular weight was decreased by around -0.50 to -0.60 % in treated Mn$_3$O$_4$ samples in 147 days. The crystallite size was calculated from the XRD graph and the results are presented in Figure 5. The crystallite size was significantly enhanced by 96% in treated Mn$_3$O$_4$ samples in

| No. of days after treatment | Control Sample Day 1 | Treated powder after 11 Days (T1) | Treated powder after 85 Days (T2) | Treated powder after 99 Days (T3) | Treated powder after 105 Days (T4) |
|----------------------------|----------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------|
| Average particle Size $d_{50}$ ($\mu$m) | 6.1 | 6.9 | 5.9 | 6.1 | 6.1 |
| Percent change in Average Particle size ($d_{50}$) | - | 13.1 | -3.3 | 0 | 0 |
| $d_{99}$, Size below which 99% particles present ($\mu$m) | 31.1 | 29.4 | 28.4 | 28.4 | 29 |
| Percent change in particle size $d_{99}$ (%) | - | -5.5 | -8.7 | -8.7 | -6.8 |

Table 1: Particle size of control and treated sample of Mn$_3$O$_4$.

| No. of days after treatment | Control | 11 | 85 | 90 |
|----------------------------|---------|---|---|---|
| Surface Area (m$^2$/g) | 3.08 | 2.95 | 2.95 | 2.77 |
| Percentage Change in Surface Area (%) | - | -4.083 | -4.259 | -9.951 |

Table 2: Surface area result of control and treated sample of Mn$_3$O$_4$ after biofield treatment.
147 days, which could be due to the reorientation of the planes in the same direction and unhindered movements of dislocations across grain boundaries, which causes reduction of dislocation density by 50% (Figure 1). Nevertheless the movement of dislocations needs large amount of energy, so it is believed that energy used for this process was provided by two different sources: biofield and the energy released during conversion of mass (as per Einstein energy equation $E=mc^2$). This fact was well supported by loss in molecular weight of treated Mn$_3$O$_4$ sample. The large difference in crystallite size and particle size can be explained by the cumulative effect of fracturing, agglomeration and consolidation process induced by energy milling through biofield treatment. Moreover the noticeable decrease in micro strain and

[Graphs and Figures]

**Figure 1:** Percent change in Particle size $d_{50}$ and $d_{99}$ result of treated Mn$_3$O$_4$ samples with time after treatment.

**Figure 2:** Average particle size ($d_{50}$) and surface area of treated Mn$_3$O$_4$ sample with time after treatment.

**Figure 3a:** XRD spectra of Control Mn$_3$O$_4$ Sample.

**Figure 3b:** XRD spectra of Treated Mn$_3$O$_4$ Sample T1 (16 days after biofield treatment).

**Figure 3c:** XRD spectra of Treated Mn$_3$O$_4$ Sample T2 (106 days after biofield treatment).

**Figure 3d:** XRD spectra of Treated Mn$_3$O$_4$ Sample T3 (131 days after biofield treatment).

**Figure 3e:** XRD spectra of Treated Mn$_3$O$_4$ Sample T4 (147 days after biofield treatment).
FT-IR spectroscopy

The FT-IR spectra of control and treated Mn₃O₄ samples are presented in Figures 6a and 6b. The FT-IR of control sample showed vibration peak at 651/cm that corresponds to Mn-O stretching in tetrahedral and 563/cm corresponds to Mn³⁺-O in octahedral positions [33]. Other important peaks were observed at 3500/cm and 1500/cm which were attributed to weakly bound moisture (water molecules) in treated and control samples [33]. In Figure 6a, it was found that the treated sample T1 has not showed any peak in the fingerprint region 450-700/cm, which was quite unexpected. It can be hypothesized that Mn-O bond was no longer exists, or strength of Mn-O bond was greatly reduced. Contrarily treated sample T2 showed intense absorption peaks at 557/cm and 613/cm which was responsible to Mn-O in octahedral and Mn³⁺-O in tetrahedral position respectively Figure 6b. It was also noticed that vibration peaks were shifted to lower wavenumber as compared to control sample that indicates that Mn-O bond length was reduced Figure 6b. Therefore, IR spectra revealed that Mn-O bond length and bond force constant was significantly altered by biofield.

Electron spin resonance (ESR) spectroscopy

The ESR spectra analysis result of control and treated Mn₃O₄...
samples are illustrated in Figure 7. It was found that the g-factor was slightly increased by 0.15%, which indicated that the angular momentum of the electrons in the atom was probably increased through biofield treatment. It was also observed that the spin resonance signal width of the treated sample was broadened by 11%, which could be due to the increase in dipole-dipole and electrostatic interaction among Mn ions with other mixed valance states [34,35]. Additionally, the resonance signal peak intensity was increased by 16% that might be due to the clustering of spins on the particle surface, that may led to enhanced the magnetisation of treated Mn₃O₄ samples. This result was also supported by increase in crystallinity and particle size [9]. Further it was hypothesized that during high energy milling through biofield treatment, spins may get clustered on the surface and enhanced the magnetisation. Furthermore, particle size analysis showed increase in particle size which is associated with the increase in volume of individual particles. Further, the increase in volume of individual particle led to enhanced the magnetic moment in individual particles of treated Mn₃O₄ [17].

Conclusion

Current research work investigates the modulation of crystalline, physical, atomic and magnetic properties of MnO₂ ceramic powders using Mr. Trivedi’s biofield. The particle size of MnO₂ powder was increased after biofield treatment, which results into reduced surface area, which may be due to combine effect of rupturing and agglomeration process. XRD result demonstrated that biofield had significantly reduced the unit cell volume by 0.60%, that was probably due to compressive stress applied during energy milling. Biofield exposed sample showed the larger crystalline size as compared to control MnO₂, which was mainly due to reduction of the dislocation density and microstrain cause reorientation of neighbouring planes in same direction and thereby increasing crystallite size. The reduction in dislocation density and microstrain could have led to enhance the paramagnetic behaviour of MnO₂. ESR results revealed that magnetization and spin-spin atomic interaction of treated sample was enhanced, which may be due to increasing in spin cluster density and high crystallinity respectively. Hence the increase in spin cluster density could lead to enhance the magnetisation of MnO₂ nanopowders. These excellent results indicates that biofield treated MnO₂ ceramic powders can be used as novel materials for fabricating magnetic data storage devices and future research is needed to explore its further applications.

Acknowledgement

We would like to give thanks to all the staff of various laboratories for supporting us in conducting experiments. Special thanks to Dr Cheng Dong of NLSC, Institute of Physics and Chinese academy of sciences for providing the facilities to use PowderX software for analyzing XRD results.

References

1. Rao CNR (1989) Transition Metal Oxides. Annual Review of Physical Chemistry 40: 291-326.
2. Han YF, Chen F, Zhong Z, Ramesh K, Chen L, et al. (2007) Preparation of nanosized Mn₃O₄/SBA-15 catalyst for complete oxidation of low concentration EIOH in aqueous solution with H₂O₂. Applied Catalysis B: Environmental 76: 227-234.
3. Wang H, Li Z, Yang J, Li Q, Zhong X (2009) A novel activated mesocarbon microbead (aMCMB)/MnO₂ composite for electrochemical capacitors in organic electrolyte. Journal of Power Sources 194: 1218-1221.
4. Pasero D, Reeves N, West AR (2005) Co-doped MnOₓ, a possible anode material for lithium batteries. Journal of Power Sources 141: 156-158.
5. Einaiga H, Futamura S (2004) Catalytic Oxidation of Benzene with Ozone over Alumina-supported Manganese Oxides. Journal of Catalysis 227: 304-312.
6. Yamashita T, Vannice A (1997) Temperature-programmed desorption of no adsorbed on MnO₂ and Mn₃O₄. Applied Catalysis B: Environmental 13: 141-155.
7. Gorbenko OY, Graboy IE, Amelichev VA, Bosak AA, Kaul AR (2002) The structure and properties of MnO₂ thin films grown by MOCVD. Solid State Communications 124: 15-20.
8. Zhang X, Yu P, Zhang D (2013) Room temperature synthesis of Mn₃O₄ nanoparticles: characterization, electrochemical properties and hydrothermal transformation to g-MnO₂ nanorods. Materials Letters 92: 401-404.
9. Shrividhya T, Ravi G, Mahalingam T, Hayakawa Y (2014) Synthesis and Study on Structural, Morphological and Magnetic properties of nanocrystalline Manganese Oxide. International Journal of Science and Engineering Applications.
10. Li G, Tang X, Lou S, Zhou S (2014) Large enhancement of ferromagnetism by Cr doping in MnO₂ nanowires. Applied Physics Letters 104: 173105.
11. Li P, Nan C, Wei Z, Lu J, Peng Q, et al. (2010) MnO₂ Nanocrystals: Facile Synthesis, Controlled Assembly, and Application. Chemistry of Material 22: 4232-4236.
12. Rohani T, Entezari MH (2012) A novel approach for the synthesis of superparamagnetic MnO₂ nanocrystal by ultrasonic bath. Ultrasonics Sonochemistry 19: 560-569.
13. Chang YQ, Yu DP, Long Y, Xu J, Luo XH, et al. (2005) Large-scale fabrication of single-crystalline MnO₂ nanowires via vapor phase growth. Journal of Crystal Growth 279: 88-92.
14. Zhang Y, Qiao T, Yahu X (2004) Preparation of MnO₂ nanocrystallites by low-temperature solvolothermal treatment of γ-MnOOH nanowires. Journal of Solid State Chemistry 177: 4093-4097.
15. Zhang W, Yang Z, Liu Y, Tang S, Han X, et al. (2004) Controlled synthesis of MnO₂ nanocrystallites and MnO₂ nanorods by a solvothermal method. Journal of Crystal Growth 263: 394-399.
16. Daniel E (2012) Novel Synthesis of Metal Oxide Nanoparticles via the Aminolytic Method and the Investigation of Their Magnetic Properties. Georgia Institute of Technology.
17. Trivedi MK, Tallapragada RR (2008) A transcendental to changing metal powder characteristics. Metal Powder Report 63: 22-28.
18. Dabhade VV, Tallapragada RR, Trivedi MK (2009) Effect of external energy on atomic, crystalline and powder characteristics of antimony and bismuth powders. Bulletin of Materials Science 32: 471-479.
19. Trivedi MK, Tallapragada RR (2009) Effect of superconsciousness external energy on atomic, crystalline and powder characteristics of carbon allotrope powders. Materials Research Innovations 13: 473-480.
20. Trivedi MK, Patil S, Tallapragada RM (2012) Thought Intervention through Biofield Changing Metal Powder Characteristics Experiments on Powder Characterisation at a PM Plant. Future Control and Automation 173: 247-252.
21. Trivedi MK, Patil S, Tallapragada RM (2013) Effect of Biofield Treatment on the Physical and Thermal Characteristics of Vanadium Pentoxide Powders. Journal of Material Sciences and Engineering 511: 001.
22. Trivedi MK, Patil S, Tallapragada RM (2013) Effect of bio field treatment on the physical and thermal characteristics of Silicon, Tin and Lead powders. Journal of Material Sciences and Engineering 2: 125.

23. Trivedi MK, Patil S, Tallapragada RM (2014) Atomic, Crystalline and Powder Characteristics of Treated Zirconia and Silica Powders. Journal of Material Sciences & Engineering 3: 144.

24. Trivedi MK, Patil S, Tallapragada RMR (2015) Effect of Biofield Treatment on the Physical and Thermal Characteristics of Aluminium Powders. Ind Eng Manage 4: 151.

25. Shinde V, Sances F, Patil S, Spence A (2012) Impact of Biofield Treatment on Growth and Yield of Lettuce and Tomato. Australian Journal of Basic and Applied Sciences 6: 100-105.

26. Sances F, Flora E, Patil S, Spence A, Shinde V (2013) Impact of Biofield Treatment On Ginseng And Organic Blueberry Yield. AGRIVITA Journal of Agricultural Science 8: 138-143.

27. Lenssen AW (2013) Biofield and Fungicide Seed Treatment Influences on Soybean Productivity, Seed Quality and Weed Community. Agricultural Journal 8: 138-143.

28. Patil SA, Nayak GB, Barve SS, Tembe RP, Khan RR (2012) Impact of Biofield Treatment on Growth and Anatomical Characteristics of Pogostemon cablin (Benth.). Biotechnology 11: 154-162.

29. Allekar N, Nayak G (2015) Effect of Biofield Treatment on Plant Growth and Adaptation. Journal of Environment and Health sciences 1: 1-9.

30. Trivedi M, Patil S (2008) Impact of an external energy on Staphylococcus epidermis [ATCC-13518] in relation to antibiotic susceptibility and biochemical reactions-An experimental study. Journal of Accord Integrative Medicine 4: 230-235.

31. Trivedi M, Patil S (2008) Impact of an external energy on Yersinia enterocolitica [ATCC -23715] in relation to antibiotic susceptibility and biochemical reactions: An experimental study. The Internet Journal of Alternative Medicine 6.

32. Trivedi M, Bhardwaj Y, Patil S, Shettigar H, Bulbul H (2009) Impact of an external energy on Enterococcus faecalis [ATCC-S1299] in relation to antibiotic susceptibility and biochemical reactions-An experimental study. Journal of Accord Integrative Medicine 5: 119-130.

33. Sherin JS, Thomas JK, Suthagar J (2014) Combustion Synthesis and Magnetic Studies of Hausmannite, Mn₃O₄ nanoparticles. International Journal of Engineering Research and Development 10: 34-41.

34. Dhaouadi H, Ghodbane O, Hosni F, Touati F (2012) Mn₃O₄ Nanoparticles: Synthesis, Characterization, and Dielectric Properties. International Scholarly Research Network ISRN Spectroscopy 1-8.

35. Winkler E, Zysler R (2004) Surface and magnetic interaction effects in Mn₃O₄ nanoparticles. Physical Review B 70: 174406.