Trivedi et al., J Material Sci Eng 2013, 2:3
http://dx.doi.org/10.4172/2169-0022.1000125

Material Science & Engineering

Research Article Open Access

Effect of Bio Field Treatment on the Physical and Thermal Characteristics of Silicon, Tin and Lead Powders

Mahendra K Trivedi, Shrikant Patil* and Rama Mohan Tallapragada

Trivedi foundation,14747 N Northsight Blvd, Suite 111-136, Scottsdale, AZ 85260, USA

Abstract

Silicon, tin and lead powders belong to group IV in periodic table and exhibit decreasing semi conducting nature towards the bottom of the group. These are very useful in producing non ferrous powder metallurgy components.

In the present investigation silicon, tin and lead powders are exposed to bio field. Both the exposed and unexposed powders are later characterized by various techniques. The average particle size, after an initial decrease is found to increase with increase in number of days after treatment although the size is lee than that exhibited by untreated powder, suggesting the operation of competing mechanisms fracture and sintering. The BET surface area increased slightly in silicon powder but did not change in tin and lead powders. SEM photographs showed that samples exposed to bio field after 20 days showed fracture paths and fractures at inter and intra particle boundaries in treated powders. Thermal analysis indicated a decrease in heat of reaction and decrease in mass in treated samples.

X-ray diffraction of the powder samples indicated both increase and decrease in crystallite size, unit cell volume and molecular weight of samples exposed to bio field even after 179 days.

These results indicate that the properties of the metallic powders can be controlled even up to atomic level by exposing to bio field.

Keywords: Biofield; Particle size; X-ray diffraction; Silicon; Tin; Lead

Introduction

Electrical currents along with associated magnetic fields that are complex and dynamic are present inside the bodies on many different scales most likely due to dynamical processes such as heart and brain function, blood and lymph flow, ion transport across cell membranes, and other biologic processes [1]. Bio field is a cumulative effect exerted by these fields of human body on the surroundings. Typically, it may act directly on molecular structures, changing the conformation of molecules in functionally significant ways as well as may transfer bio-information through energy signals interacting directly with the energy fields of life. At the balanced intersection of human and machine adaptation is found the optimally functioning brain-computer interface (BCI) [2]. Experiments are reported of BCI controlling a robotic quad copter in three-dimensional (3D) physical space using non invasive scalp electroencephalogram (EEG) in human subjects.

Mr. Mahendra. K. Trivedi is known to transform the characteristics of various living and non- living materials through bio field in his physical presence as well as through his thought intervention. The details of several scientific investigations and the results in the form of original data are reported elsewhere [3-7].

The present paper reports the changes in the characteristics of powders of group IV elements silicon, tin and lead after exposure to the bio field of Mr. Trivedi.

Experimental

Silicon (-325 mesh), tin (-325 mesh) and lead (-200 mesh) powders of Alpha Aesar are used in the present investigation. The purity of the powders is respectively 99.5, 99.8 and 99%. Both untreated and powders exposed to thought intervention of Mr. Trivedi at different times are characterized by Laser particle size analysis, Specific surface area (BET), X-ray Diffraction (XRD), Thermo Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA) and Simultaneous Differential Thermal Analysis (SDTA).

Average particle size and size distribution are obtained using SYMPATEC HELOS-BF laser particle size analyzer with a detection range of 0.1 to 875 μm (micro meters). From the particle size distribution, d_{50} the average particle size and d_{99} (maximum particle size below which 99% of particles are present) for the control (untreated or as received powders) are taken as standard and are compared with the results obtained on four separately treated powders. Surface area determination is carried out using a SMART SORB 90 BET surface area analyzer with a measuring range of 0.2 to 1000 m^2/g.

X-ray diffraction is carried out using a powder Phillips, Holland PW 1710 XRD system. A copper anode with nickel filter is used. The wavelength of the radiation is 1.54056 Å (10^{-10} m or 10^{-8} Cm). The data is obtained in the form of 2θ *vs.* Intensity chart as well as a detailed table containing 2θ°, d value Å, peak width 2θ°, peak intensity counts, relative Intensity %, etc. The'd' values are compared with standard JCPDS data base and the Miller Indices h, k and l for various 2θ° values are noted. The data are then analyzed using PowderX software to obtain lattice parameters and unit cell volume.

Thermo gravimetric analysis (TGA) and simultaneous differential thermal analysis (SDTA) combined analyses are carried for the tin and lead powders from room temperature to 400°C at a heating rate of 5°C/min in air. While for silicon powder thermo gravimetric analysis (TGA) and differential thermal analysis (SDTA) combined analysis are

***Corresponding author:** Shrikant Patil, Trivedi foundation,14747 N Northsight Blvd, Suite 111-136, Scottsdale, AZ 85260, USA, E-mail: research@trivedifoundation.org

Received August 07, 2013; **Accepted** August 29, 2013; **Published** September 08, 2013

Citation: Trivedi MK, Patil S, Tallapragada RM (2013) Effect of Bio Field Treatment on the Physical and Thermal Characteristics of Silicon, Tin and Lead Powders. J Material Sci Eng 2: 125. doi:10.4172/2169-0022.1000125

carried out from room temperature to 1450°C at a heating rate of 40°C/min in air. Scanning Electron microscopy of untreated and treated powders is carried out using a JEOL JSM-6360 instrument.

Results

Particle size and size distribution

Particle size and particle size distribution was determined by laser particle size analyzer. From these data the average particle size d_{50}, d_{10} and d_{99} the sizes below which 10 percent and 99 percent of particles are present respectively are noted for both untreated and samples treated for 11, 86, 91 and 109 days and given in Table 1. To understand whether coarser, or finer particles have changed on treatment, percent particles finer than average particle size in treated powders were evaluated using the relation $[100*(d_{50}-d_{10})/d_{10}]$. Similarly percent particles coarser than average particle size in treated powders were evaluated using the relation $[100*(d_{99}-d_{50})/d_{50}]$. These parameters are plotted as function of time 't' in number of days after treatment and shown in Figure 1. Lead powder on treatment showed a decrease in percent of coarse as well as fine particles. Coarse tin particles showed an initial percent decrease followed by increase on prolonged treatment, while finer tin particles showed slight increase as well as decrease. Both coarse and fine silicon particles did not show significant changes in size on treatment.

Specific surface area

The specific surface areas of both untreated and treated powders as determined by BET technique are given in Table 2. Rationalization of the parameter was done by computing the percent change in specific surface area between untreated and treated powders $\Delta s\% = 100*(s_t - s_0)/s_0$. The specific surface area of treated tin powders did not show any change while that of silicon and lead powders showed increase.

Number of days after treatment	Particle size (d10) in micrometers			Average particle size (d50) in micrometers			Particle size (d99) in micrometers		
	Silicon	Tin	Lead	Silicon	Tin	Lead	Silicon	Tin	Lead
0	1.33	5.13	19.95	4.2	28.5	71.8	10.6	147.6	348.3
11	1.04	4.05	14.11	3.8	18.1	38.3	10.1	89.5	128.5
86	0.97	4.93		3.7	25.1		9.8	114.6	
91	1.39	3.79		4.2	17.4		10.6	114	
109	1.4	4.5		4.2	21.1		10.5	122.4	

Table 1: Average particle size d50 and d99 the size below which 99% of the particles are present in untreated as well as powders treated after different number of days.

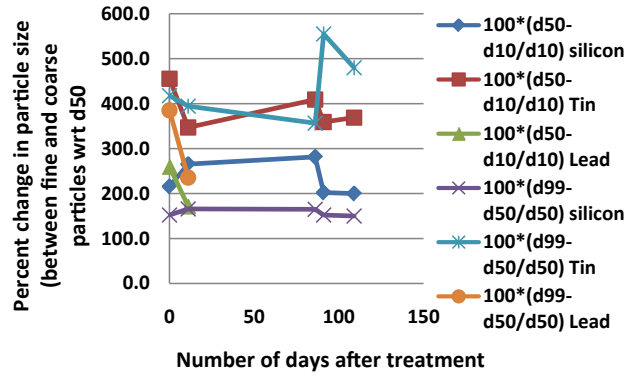


Figure 1: Percent change in particle size of particles finer and coarser than average particle size d50 as a function of number of days after treatment.

Number of days after treatment	BET Surface area (m^2/g)			Percent change in Surface area on treatment		
	Silicon	Tin	Lead	Silicon	Tin	Lead
0	1.96	0.11	0.04			
20		0.11			0.00	
21			0.07			75.00
22	3.12			59.18		
105	3.26			66.33		
124	3.10			58.16		

Table 2: BET surface area and percent change in surface area of untreated and treated powders.

Scanning electron microscopy

The powders were examined in a Scanning Electron Microscope (SEM). SEM pictures of both untreated and treated powders respectively are shown in Figure 2. It is evident that on treatment a reduction in size of lead particles had occurred while there was no significant change in size of tin particles. Internal boundaries where the particles got welded can be noticed in large particles.

X-ray Diffraction

What must be happening to cause these significant changes in particle size and surface area? In order to find a probable cause the powders were examined by x ray diffraction.

Data analysis: Obtained 'd' values from the x-ray spectra were compared with standard JCPDS data base and the Miller Indices h, k and l for various 2θ° values were noted. The data were then analyzed using PowderX software to obtain lattice parameters and unit cell volume.

The crystallite size was calculated using the formula,

Crystallite size = $k\lambda / b \cos\theta$

where, λ is the wavelength of x-radiation used (1.54056×10^{-10} m), 'b' is the peak width at half height, and k is the equipment constant with a value 0.94. The obtained crystallite size will be in nano meters or 10^{-9} m. Crystallite size in metals can correspond to sub grain size when the grain size is equivalent to single crystal size. It is also possible that some part of the observed X-ray peak width could be due to the instrument broadening (already corrected) while the other part could be due to the strain in the crystal lattice.

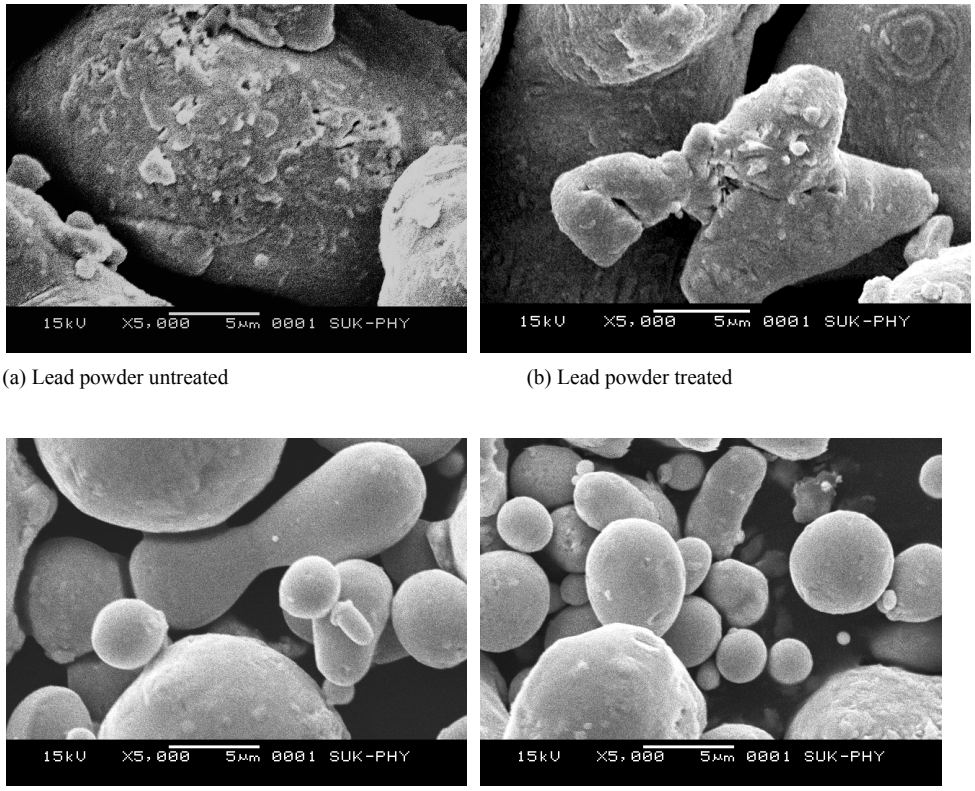
The change between various powders was assessed by using relative parameters as follows:

Percent change in lattice parameter is the ratio of difference in the values between untreated and treated powders to the value of untreated powders expressed as per cent. Typically for the parameter 'a' this is equal to $100*(\Delta a/a_c)$ where $\Delta a=(a_t - a_c)/a_c$. This is also known as strain, and, when multiplied with the elastic modulus gives the force applied on the atoms. When the force is compressive the change is negative while a positive value indicates a stretching or tensile force. In a similar manner the percent change in unit cell volume and crystallite sizes were computed.

The weight of atom was computed from the sum of all electrons, protons and neutrons.

Weight of atom=number of protons×weight of proton+number of neutrons×weight of neutron+number of electrons × weight of electron

Since the number of atoms per unit cell of the crystal was known, the weight of the unit cell was computed. The latter divided by the



(a) Lead powder untreated (b) Lead powder treated

(c) Tin powder untreated (d) Tin powder treated

Figure 2: Scanning electron micrographs of untreated and treated lead and tin powders.

volume of the unit cell gives the theoretical density. Since the volume of unit cell of the powder changes on treatment, the density as well as weight of atom will also change.

The weight of the atom when multiplied by the Avogadro's number (6.023×10^{23}) gives the atomic weight (M) or the weight of a gram atom of the substance. The ratio difference in atomic weight between untreated and treated samples to the atomic weight of untreated sample was then expressed as per cent change in atomic weight. Typically this is same as $100\times(\Delta M/M_c)$ where $\Delta M=(M_t-M_c)/M_c$. This value also represents the percent change in sum of weights of protons and neutrons in the nucleus.

The percent change in positive charge per unit volume of the atom was computed as follows;

The atomic radius was obtained by dividing the lattice parameter 'a' with 2.

$r = a/2$

Then the volume of the atom was obtained by assuming it to be spherical $V = 4\pi r^3/3$

The positive charge per unit volume of the atom was computed by multiplying the number of protons (p) in the atom with elementary charge 1.6×10^{-19} coulombs and then by dividing with the volume of the atom. The percent change in positive charge per unit volume ΔZ between untreated and treated powders was then obtained as

$\Delta Z\% = 100(Zt^+-Zc^+)/Zc^+$

Results of XRD: The results of XRD obtained after data analysis are given in Tables 3a-3d. Variation in percent change in unit cell volume and percent change in atomic weight with number of days after treatment (Table 3a, 3c and Figure 3) showed similar behavior for all the powders. An initial increase followed by decrease in case of lead powders, while the reverse this initial decrease followed by increase in case of silicon and tin powders. Percent nuclear charge per unit volume of atom showed exactly opposite variation. An initial decrease followed by increase in case of lead powders, and initial increase followed by decrease in case of silicon and tin powders (Figure 4). The variation in crystallite size is shown in Figure 5. Lead powder showed an initial decrease followed by increase. Silicon powders showed a continuous decrease followed by a steady crystallite size corresponding to that exhibited by untreated powders. Tin powders showed a decrease followed by increase reaching a steady state crystallite size.

Results of thermal analysis: Change in thermal characteristics of treated lead and tin powders in nitrogen atmosphere and air were studied using DSC and SDTA respectively (Table 4 and 5). DSC results indicated no significant change in melting point. The latent heat of fusion (ΔH) in treated lead and tin powders had decreased up to a maximum of 11.85 and 20.71%. The percent change in ΔH between untreated and treated powders is shown in Figure 6. The percent change in mass between the initial powders and the powders at respective melting points (Figure 7) as well as the percent change in equivalent ΔH (as measured by SDTA in air) between untreated and treated powders is shown in Figure 8. The mass at melting point in both lead and tin powders had decreased up to 7.23 and 5.78% respectively indicating vaporization. The equivalent latent heat of fusion in treated lead and tin powders had decreased up to a maximum of 43.07 and

	Number of days after treatment	Volume of unit cell × 10^-24 Cm^3			Percent change in volume of unit cell		
		Silicon	Tin	Lead	Silicon	Tin	Lead
Control	0	158.81	108.06	121.94			
Treated T1	69	158.97			0.096		
	67		108.46			0.366	
	7			121.83			-0.090
Treated T2	133	158.9	108.06		0.055	-0.004	
Treated T3	157	158.94			0.081		
	164		108.2			0.130	
	38			122.03			0.071
Treated T4	179	158.97			0.100		
	178		108.51			0.415	
	48			121.97			0.020

Table 3a: Volume of the unit cell, and percent change in volume for control and treated powders.

	Number of days after treatment	Effective nuclear charge per unit volume of the atom (Coulombs/Cm3) × 10^3			Percent change in effective nuclear charge		
		Silicon	Tin	Lead	Silicon	Tin	Lead
Control	0	26.93	77.18	205.4			
Treated T1	69	26.90			-0.096		
	67		76.76			-0.547	
	7			205.6			0.091
Treated T2	133	26.92	77.18		-0.055	0.006	
Treated T3	157	26.91			-0.081		
	164		77.03			-0.195	
	38			205.3			-0.070
Treated T4	179	26.90			-0.100		
	178		76.70			-0.619	
	48			205.4			-0.019

Table 3b: Effective nuclear charge per unit volume of the atom, and percent change in this parameter for control and treated powders.

	Number of days after treatment	Atomic weight (Grams/gram atom)			Percent change in atomic weight		
		Silicon	Tin	Lead	Silicon	Tin	Lead
Control	0	28.24	120.029	208.797			
Treated T1	69	28.267			0.096		
	67		120.469			0.366	
	7			208.608			-0.090
Treated T2	133	28.255	120.025		0.055	-0.004	
Treated T3	157	28.262			0.081		
	164		120.186			0.130	
	38			208.944			0.071
Treated T4	179	28.268			0.100		
	178		120.527			0.415	
	48			208.838			0.020

Table 3c: Atomic weight and percent change in atomic weight for control and treated powders.

31.17% respectively. The decrease in latent heat of fusion in all the treated powders without significant change in melting temperature suggests that the powders are already in a high energy state prior to melting.

Discussions

Particle can be single crystals or poly crystalline. In the later case the grain boundaries (boundaries between adjacent single crystals) are the structural weak points and can fracture under stress reducing the particle size. However, the fracture of particles creates fresh surfaces which are amenable for cold welding of such surfaces increasing the particle size. Thus changes in particle size are alternately attributed to fracture, creation of fresh particle surfaces and welding. This kind of behavior is exhibited by tin particles. Silicon being covalent bonded is strong and showed least deformation of coarse particles while deformation along cleavage planes may have contributed to increase in

	Number of days after treatment	Crystallite size × 10^{-9} m			Percent change in crystallite size		
		Silicon	Tin	Lead	Silicon	Tin	Lead
Control	0	71.1	107.67	71.6			
Treated T1	69	106.7			50		
	67		143.41			33.27	
	7			85.9			20
Treated T2	133	85.3	107.6		20	-0.01	
Treated T3	157	71.1			0		
	164		143.44			33.29	
	38			53.7			-25
Treated T4	179	71.1			0		
	178		143.49			33.25	
	48			61.4			-14.3

Table 3d: Crystallite size and percent change in crystallite size of control and treated powders.

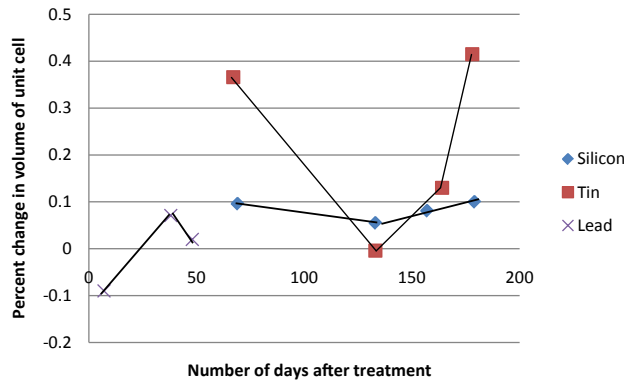


Figure 3: Percentage change in volume of unit cell of treated powders.

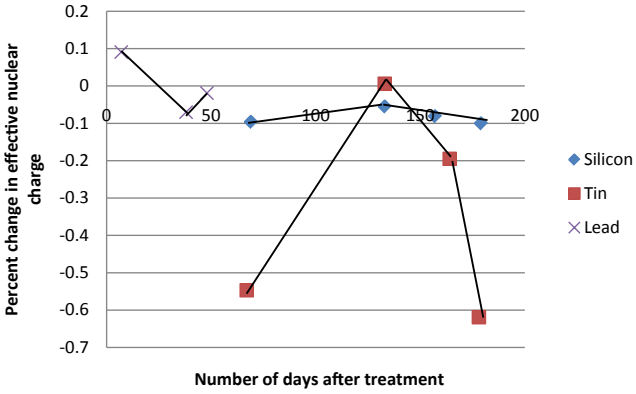


Figure 4: Percentage change in effective nuclear charge per unit volume of the atom.

size of fine particles. Lead being the weakest material showed decrease in size of both fine and coarse particles.

These results are also in agreement with increased surface area. The existence of internal particle boundaries and fracturing of coarse particles into finer ones will certainly increase the surface as observed. Scanning electron micrographs of treated lead powder showed fractured particles and internal boundaries that may have contributed to increased surface area.

X-ray diffraction of treated silicon and tine powders showed decreased unit cell volume and atomic weight while it increased the percent change in nuclear charge per unit volume of atom. Decrease in nuclear charge per unit volume indicates increase in atomic volume or decrease in number of positively charged protons. This reduced charge will attract the neighbouring atoms with lesser force thus increasing the unit cell and crystallite size as was observed in the present experiments. The interesting result observed in the present experiments is that the percent change in atomic weight is inversely proportional to percent change in nuclear charge per unit volume of atom and *vice versa*. This is only possible if protons are converted to neutrons and *vice versa*. That is bio energy mediates energy conversion to mass and mass conversion to energy through interchange of protons and neutrons.

Conclusions

Bio field exerted by Mr. Trivedi on aluminium metal powders had caused the following effects:

1. Changes in particle size of powders on treatment are alternately attributed to fracture, creation of fresh particle surfaces and welding.
2. The specific surface area of the treated powders had increased with increase in number of days after treatment which was also consistent with decreased percent of coarser particles.
3. Scanning electron microscopy indicated internal boundaries and angular particles thus justifying the observed decrease in surface area.
4. Results of X-ray diffraction had showed that treatment with bio field had decreased the percent change in both unit cell volume and atomic weight while it increased the percent change in

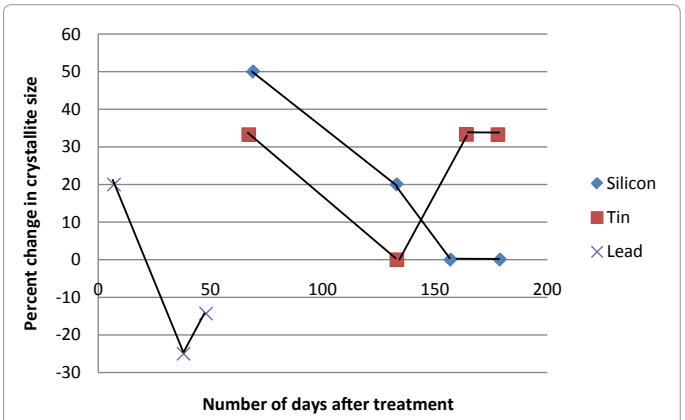


Figure 5: Percentage change in crystallite size in treated powders.

Parameter	Number of days after treatment	Lead	Tin
ΔH J/g	0	21.18	56.60
	18	20.99	
	19		56.74
	22	18.67	54.37
	25	21.97	44.88
Percent change in ΔH	18	-0.90	
	19		0.25
	22	-11.85	-3.94
	25	3.73	-20.71

Table 4: Differential scanning calorimetry of lead and tin powders.

Parameter	Number of days after treatment	Lead	Tin
Peak integral from SDTA s°C	0	25.56	100.63
	11	37.70	
	15		112.49
	64	25.62	
	68		179.53
	76	35.18	
	80		136.51
	96	60.07	
	100		246.92
K-conversion factor to DSC	0	7.40	6.13
	11	7.40	
	15		6.13
	64	7.40	
	68		6.13
	76	7.40	
	80		6.13
	96	7.40	
	100		6.13
Mass of sample mo mg	0	10.29	13.14
	11	14.89	
	15		14.05
	64	18.11	
	68		34.06
	76	23.90	
	80		25.22
	96	22.55	
	100		28.56
Latent heat of fusion ΔH J/g	0	18.39	46.92
	11	18.73	
	15		49.06
	64	10.47	
	68		32.29
	76	10.89	
	80		33.16
	96	19.70	
	100		52.96
Melting Point °C	0	325.71	232.91
	11	325.98	
	15		232.66
	64	324.99	
	68		234.04
	76	326.17	
	80		232.87
	96	327.04	
	100		232.86
Mass of sample at melting point m_o	0	9.88	12.38
	11	14.73	
	15		13.63
	64	16.80	
	68		33.30
	76	22.60	
	80		24.20
	96	22.50	
	100		28.67
Percent change in mass	0	-3.94	-5.78
	11	-1.11	
	15		-2.98
	64	-7.23	
	68		-2.23
	76	-5.45	
	80		-4.06
	96	-0.23	
	100		0.38
	11	1.88	
	15		4.56
	64	-43.07	
	68		-31.17
	76	-40.78	
	80		-29.33
	96	7.17	
	100		12.88

Table 5: Simultaneous differential thermal analysis (SDTA) of lead and tin powders.

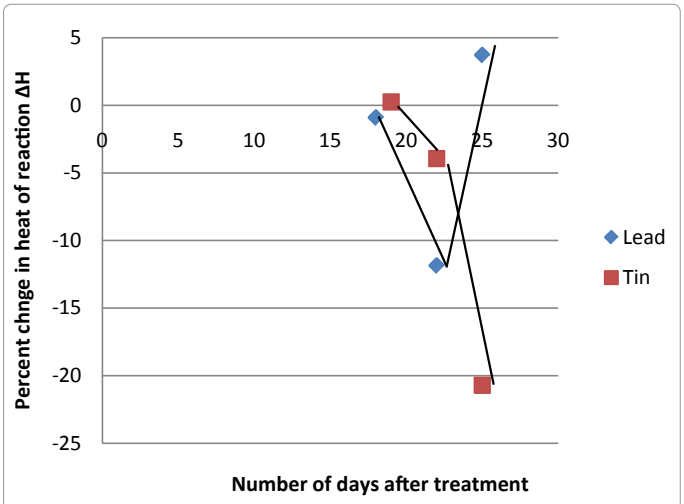


Figure 6: Percent change in ΔH between untreated and treated powders as determined by DSC.

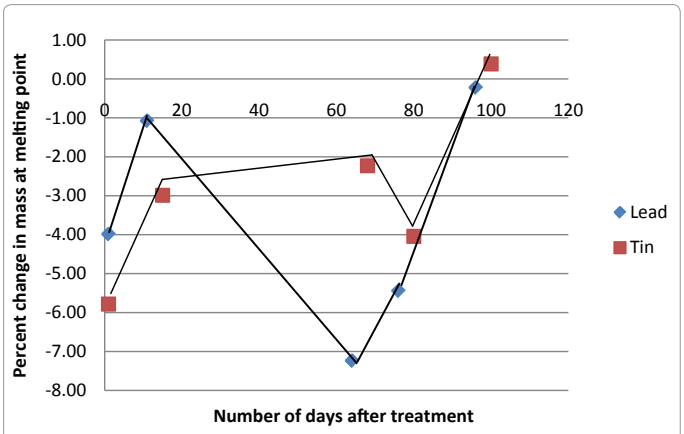


Figure 7: Percent change in mass at melting point as determined by SDTA.

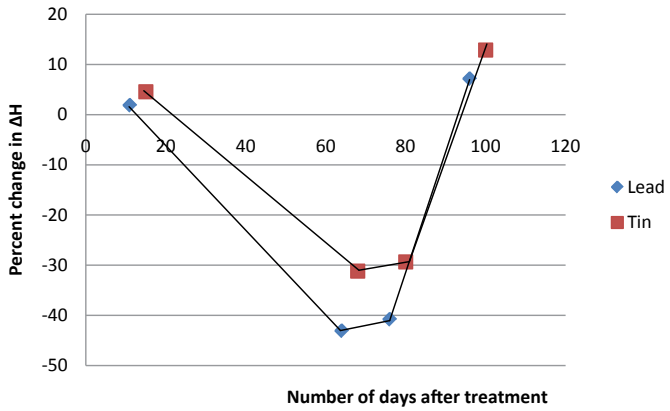


Figure 8: Percent change in ΔH as determined by SDTA.

nuclear charge per unit volume of atom. These results suggest that bio energy had mediated energy conversion to mass and mass conversion to energy through interchange of protons and neutrons in the nucleus.

5. Thermal analysis of the tin and lead powders indicated a decrease in latent heat of fusion in all the treated powders without significant change in melting temperature, suggesting that the powders were already in a high energy state prior to melting.

Acknowledgement

We thank the staff of various laboratories for conducting various characterization experiments. We thank Dr. Cheng Dong of NLSC, Institute of Physics, and Chinese academy of Sciences for permitting us to use PowderX software for analyzing XRD results.

References

1. Rubik B (1994) Bioelectromagnetics applications in medicine. Alternative medicine: expanding medical horizons: a report to the National Institutes of Health on alternative medical systems and practices in the United States (NIH publication no. 94-066). US Government Printing Office, Washington DC, USA.
2. LaFleur K, Cassady K, Doud A, Shades K, Rogin E, et al. (2013) Quadcopter control in three-dimensional space using a noninvasive motor imagery-based brain–computer interface. J Neural Eng.
3. http://www.trivediscience.com/materials-science/
4. Trivedi MK, Tallapragada RM (2008) A transcendental to changing metal powder characteristics. Met Pow Rep 63: 22-28, 31.
5. Dabhade VV, Trivedi MK, Tallapragada RM (2009) Effect of external energy on the atomic, crystalline, and powder characteristics of antimony and bismuth. Bull Mat Sci 32: 5471-5479.
6. Trivedi MK, Tallapragada RM (2009) Effect of super consciousness external energy on atomic, crystalline and powder characteristics of carbon allotrope powders. Mat Res Inno 13: 473-480.
7. Trivedi MK, Patil S, Tallapragada RM (2013) Effect of Bio Field Treatment on the Physical and Thermal Characteristics of Vanadium Pentoxide Powders. J Material Sci Eng S11: 001.

Citation: Trivedi MK, Patil S, Tallapragada RM (2013) Effect of Bio Field Treatment on the Physical and Thermal Characteristics of Silicon, Tin and Lead Powders. J Material Sci Eng 2: 125. doi:10.4172/2169-0022.1000125