The nation's future success lies with science and education!

Heydar Aliyev
National Leader of Azerbaijan

INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH

PART A.
APPLIED AND NATURAL SCIENCES

Vol. 7. No. 3. Iss.1
May, 2015

Member of CrossRef

DOI: 10.7813/2075-4124.2015

Daxil edillən elmi bazalar:
Indexed by:

Master Journal List (ISI-Thomson Reuters, USA)
CAB Abstracts (ISI-Thomson Reuters, USA)
Zoological Records (ISI-Thomson Reuters, USA)
Norwegian Social Science Data Services (Norway)
Zentralblatt MATH (Springer-Verlag, European Math. Society, Germany)
IndexCopernicus International (Poland)
EBSCO-Academic Search Complete (USA)
ULRICH's Web (USA)

"PROGRESS" IPS
Baku, Azerbaijan, 2015
INTERNATIONAL JOURNAL of ACADEMIC RESEARCH
Vol. 7, No. 3, Iss.1, May, 2015, Part A
DOI for issue: 10.7813/2075-4124.2015/7-3

Editor-in-chief:
Dr. Dz.Dzafarov

Executive editor:
A.Khankishiyev

International Advisory and Editorial Board

Manuel Alberto M. Ferreira (Portugal)
Maybelle Saad Gaballah (Egypt)
Mehmet Bayansaliduz (Turkey)
Michael F. Shaughnessy (USA)
Sarwoko Mangkoedhardjo (Indonesia)
Savina Nadeja Nikolaeva (Russia)
Jose Antonio Filipe (Portugal)
Yury Bilan (Poland)
Enkelena Qafeshli (USA)
Elizabeth Hepburn (Australia)
Floriana Popescu (Romania)
Salvatore Lorusso (Italy)
Ionel Bostan (Romania)
Angela Mari Brakda (Italy)
Ivan Sosa (Croatia)
Veronica Vivanco (Spain)
Cemil Tunc (Turkey)
Alunca V. Moraru (Romania)
Dorien DeTombe (The Netherlands)

All rights reserved.
No part of this journal may be reprinted or reproduced without permission in writing from the publisher, the "Progress IPS"

Publishing bimonthly
Print ISSN: 2075-4124
Online ISSN: 2075-7107
National reg. No. 2996

Editorial office:
97/2, 1.Gutashinιi str.,
Baku, Azerbaijan
E-mail: subijar@gmail.com

Beynəxalq Elmi Araştırma Jurnalları (BEAJ)
2009-ci il, Milli Mətbuat Gündərində Azərbaycan Respublikası Cədiləşmə Nazirliyi tərəfindən rəsmi Dövlət Cədvəltə alınır (Nö. 2996). BEAJ Beynəxalq ISSN Markezində (Paris, Frans) cədvəltə alınmaq metni açsları və nəzərə alınan kimə ISSN 2075-4124, elektron jurnal kimə E-ISSN 2075-7107 nəzərə alınmaq nəzərə alınır.


Format: 60x84 1/4, Şrift: Arial. Tiraj: 300
Jurnal "Progres IPX" tərəfindən naşqa hazırlanmış və qap olunub.
# TABLE OF CONTENTS

## PART A. APPLIED AND NATURAL SCIENCES

### 1ST ISSUE

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manuel Alberto M. Ferreira</td>
<td>THE VECTOR SPACE CONVEX PARTS SEPARATION AS A CONSEQUENCE OF THE HAHN-BANACH THEOREM</td>
<td>8</td>
</tr>
<tr>
<td>Halil Ibrahim Ozturk, Meryem Nur Aydede Yalcin</td>
<td>ASSESSMENT OF SCIENCE AND TECHNOLOGY TEACHERS' PERCEPTIONS TOWARDS ACTIVE LEARNING</td>
<td>12</td>
</tr>
<tr>
<td>Indah Lestari, Suharto, Nyoman Anita Damayanti, Hamidah</td>
<td>A REVIEW ON COMMUNICATION, CORRECTION AND CONFIRMATION AS PRESSURE FOR NURSE COMPLIANCE</td>
<td>22</td>
</tr>
<tr>
<td>Nermene S. Afifi, Ehab S. Abdel-Hamid, Houry M. Baghdadi</td>
<td>CYCLO-OXYGENASE-2 IMMUNOLocalIZATION IN ORAL LEUKOPLAKIA</td>
<td>26</td>
</tr>
<tr>
<td>Nima Mosavat, Mohammad Chamani, Farhad Foroudi, Ali Asghar Sadeghi</td>
<td>THE EFFECTS OF DIFFERENT LEVELS OF BETAINe-HCL IN DIETS ON BROILER PERFORMANCE, CHARACTERISTICS CARCASS AND BLOOD LIPIDS</td>
<td>32</td>
</tr>
<tr>
<td>Eko Prianto, Mohammad Mukhlis Kamal, Ismudi Muchsin, Endi Setiadi Kartamihardja</td>
<td>DIVERSITY AND SEASONAL DYNAMICS OF LARVAE AND JUVENILE FISHES IN LUBUK LAMPAM, OGAN KOMERING ILIR REGENCY</td>
<td>37</td>
</tr>
<tr>
<td>Najla O. Ayaz</td>
<td>BIOCHEMICAL STUDIES FOR OPTIMUM PRODUCTION OF PHYTASE AND ACID PHOSPHATASE USING B.48</td>
<td>44</td>
</tr>
<tr>
<td>M. Oguz Sinemillioglu, Can Tuncay Akin, Havva Ozyilmaz, Ersin Uysal</td>
<td>METAMORPHOSES IN HOUSING DEMAND: CASE OF DIYARBAKIR CITY, TURKEY</td>
<td>50</td>
</tr>
<tr>
<td>Sakineh Niktash, Fatemeh Ghanbary</td>
<td>INVESTIGATION CATALYTIC ACTIVITY OF TiO2, NANO PARTICLES PREPARED UNDER VARIOUS OPERATIONAL PARAMETERS ON THE REMOVAL OF MALACHITE GREEN</td>
<td>59</td>
</tr>
<tr>
<td>Ida Bagus Putu Adnyana, Christiono Utomo, Ria A.A. Soemarto, Nadjadjii Anwar</td>
<td>CRITICAL SUCCESS FACTORS OF PUBLIC-COMMUNITY PARTNERSHIP IN BALI TOURISM INFRASTRUCTURE DEVELOPMENT</td>
<td>65</td>
</tr>
<tr>
<td>Suheyla Elmas</td>
<td>GOLDEN RATIO IN PLANE AND SPHERE</td>
<td>70</td>
</tr>
<tr>
<td>Hanan S. Alnahdi</td>
<td>FERMENTATIVE PRODUCTION OF ACID PHOSPHATASE FROM A LOCAL ISOLATE OF BACILLUS SP. 48</td>
<td>79</td>
</tr>
<tr>
<td>Hafedh Zayani, Akram M. Mostfa, Kamel Barkaoui</td>
<td>ESH-MAC ENERGY SAVING HYBRID MAC PROTOCOL FOR WSNS</td>
<td>85</td>
</tr>
<tr>
<td>Ozge Iskanoglu, Gulay Usta</td>
<td>DETERMINATION OF SPATIAL PROPERTIES OF ANKARA HOTELS</td>
<td>95</td>
</tr>
<tr>
<td>Mohamad S. Ayoub, Effat A. Abbas, Houry M. Baghdadi, Dina S. Abd El Fattah, Heba E. Tarek</td>
<td>OVDONOGENIC AND CHONDROGENIC DIFFERENTIATION OF BONE MARROW DERIVED STEM CELLS</td>
<td>99</td>
</tr>
<tr>
<td>Seyed Mousa Golestan, Rezvan Hayat, Ali Pouladi Reishehri</td>
<td>THE EFFECTIVENESS OF GROUP THERAPY TRAINING ON IMPROVEMENT OF POSITIVE AND NEGATIVE AFFECT SYNDROMES AND REDUCTION OF PSYCHOTIC SYMPTOMS IN CHRONIC AND NON-CHRONIC SCHIZOPHRENIA PATIENTS THROUGH CONTROLLING DEMOGRAPHIC VARIABLES</td>
<td>107</td>
</tr>
</tbody>
</table>
INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH

Vol. 7. No. 3. Iss.1. May, 2015


REPRODUCTIVE PEAK, GONADAL CYCLE AND GAMETOGENIC CELLS DETERMINATION OF SEA CUCUMBER PARACUCUMA AUSTRALIS FROM MADURA STRAIT, EAST JAVA, INDONESIA

M.M. Rady, A.A. El-Shewy, M.A.M. Abdelpary

RESPONSE OF COMMON BEAN PLANTS TO A NOVEL ORGANO-MINERAL FERTILIZER AS A PARTIAL SUBSTITUTION TO MINERAL-NPK FERTILIZERS UNDER A MODERATE-SALINE SOIL

Peyman Akhavan, Khosro Sepehr Tamaddoni, Parisa Roshanpanah Azali

PRIORITIZATION OF THE FACTORS INFLUENCING ELECTRONIC GOVERNMENT SERVICES APPLICATION: A FUZZY TOPSIS APPROACH

Bassem Mohsen Abd El-Hameed, Ingy Amin Talaat, Marwa Ezat Sabat

EFFECT OF RESILIENT LINER ON MINI IMPLANT NUMBER SUPPORTING MANDIBULAR OVER-DENTURE

Azadeh Alizadeh Pahlavani, Hossein Salimian, Hossein Soleimani

CHECK THE STATUS OF THE DOING BUSINESS ON IMPROVING INVESTMENT IN PHARMACEUTICAL INDUSTRY

Wara Pramstli, Gangga Anuraga, Ch. S. Menuk

STRUCTURAL EQUATION MODELING PARTIAL LEAST SQUARE (SEM PLS): ENTREPRENEURIAL SPIRIT OF STREET VENDORS IN SURABAYA

Mostafa Fatnahi

THE STUDY OF THE EFFECTIVENESS OF TECHNOLOGY TRANSFER IN IRAN’S AUTOMOTIVE INDUSTRY BASED ON DAVID’S MODEL (A Case Study of Iran Khodro Company)

Hadi Paryzino, Tijpto Suwandi, Hamidah

STRUCTURAL EFFECT OF BIG FIVE PERSONALITY ON PARTICIPATION IN SAFETY AND SOPS COMPLIANCE ON OCCUPATIONAL SAFETY

Rami Dirar Malmawi, Mustafa Bani Khalaf, Belaaz Zaqbal, Saleh Ali Alomari

AN ENHANCED FIRST SEGMENT CACHING SCHEME (EFSCS) FOR MOBILE AD-HOC NETWORK BASED ON VIDEO ON DEMAND SYSTEM

Yuly Peristiotati, Achmad Rudijanto, Djanggian Sargowo, Retty Ratnawati, Intan Fazrin, Priyo Bekti, Byba Melida Suhita, Evi Setyaningrum, Yenny Puspitasari, Nurwiyanty, Aprian Rendra

ANTIDIABETIC ACTIVITY OF GMB-4 GREEN TEA CATECHINS IN RATS DEVELOPING TYPE 2 DIABETES MELLITUS MICE WITH INSULIN RESISTANCE

Marwa Nagl Meheisen, Nadia Ali Moh. Gouda, Omayya Anwar Khorshid, Manar Ayoub, Ghada Mohamed Hashem

COMPARATIVE STUDY OF THE ANTI-INFLAMMATORY EFFECT OF SIMVASTATIN, ROSUVASTATIN ALONE AND COMBINED WITH PREDNISOLONE ON EXPERIMENTAL MODEL OF INFLAMMATORY BOWEL DISEASE

Lalu Muhammad Saleh, Tijpto Suwandi, Hamidah

LEVEL OF VIGILANCE FOR STAFFS IN AIR TRAFFIC CONTROLLER (ATC) IN INDONESIA. 2014

Ghaida Hassan I,AL-saggaF

TOWARDS DESIGNING THE MODERN ABSTRACT PAINTING USING THE IMAGE AND THE TECHNOLOGICAL STRANGENESS

Azim Rezaei Motlagh, Mojtaba Behzad Fallahpour, Hamid Dehghani

SPECKLE NOISE IN SPACEBORN SAR IMAGES AND REDUCING ITS EFFECT BY MULTI-LOOKING TECHNIQUES

Purnama Salura, Fecianti

THE SYNTHESIS OF DIAGRAM METHOD AND LOCAL APPROACH IN ARCHITECTURAL DESIGN

Fouad A. Ahmed, Osama Konswa, Mohamed Kamal El-Bahhr, Mohel El-Din M. Solliman, Marwa E. Elkashef, Alaa M. Heikal

ISOLATION CLONING AND EXPRESSION OF CRY1 AB DELTA ENDOXOIN GENE FROM EGYPTIAN STRAINS OF BACILLUS THURINGIENSIS TOXIC AGAINST PLANT PARASITIC NEMATODES

Purnama Salura

RETHINKING ARCHITECTURAL DESIGN STUDIO EDUCATION IN GLOBAL ERA

4 | PART A. APPLIED AND NATURAL SCIENCES

ISSN: 2075-4124
Mehsan Khezri, Mohsen Mohamadi
THE EFFECT OF HOPE THERAPY ON REDUCTION OF ACADEMIC PROGRAMMATION: THE CASE STUDY OF PTSD STUDENTS

Bambang Widjanarko Otok, M. Nadjib Usman
ADJACENT MODEL OF IMPECUNIOUS HOUSEHOLD IN EAST JAVA USING STRUCTURAL EQUATION MODELING SPATIAL

Sherine A. Hashem, Inas Sami, Taheya A. Moussa
BIODEGRADATION OF CHITOSAN/BIOGLASS COMPOSITES VERSUS CHITOSAN SCAFFOLD

Mohammad Jafar Rashidi, Arash Shams Taleghani
THERMOECONOMIC ANALYSIS OF SOLAR ABSORPTION REFRIGERATION CYCLE WITH PARABOLIC COLLECTORS AND WORKING FLUIDS WATER-AMMONIA

Rusdi N. Hidayat, Bambang Widjanarko Otok, Eddy Poernomo, Nur Asikin Amin
TAXPAYER COMPLIANCE MODELLING OF BUSINESS SECTORS HOTEL IN MATARAM USING PARTIAL LEAST SQUARE

Touraj Dehghani
A PATTERN FOR OPTIMUM COMBINATION OF UPSTREAM PETROLEUM COMPANIES ASSETS

Syafiuddin Paranreni, Husain Syam, Arfin Achmad, Muis Mappaloteng
MEDIA ANIMATION EFFECT LEARNING ON LEARNING OUTCOMES OF MOTORCYCLE ENGINEERING FOR THE VOCATIONAL STUDENTS

Fatemeh Hajjani, Nasir Parhizgar
HYPER SPECTRAL IMAGES COMPRESSION USING SPATIAL INFORMATION AND WAVELET TRANSFORM

Ayman H.A. Mahdi
PRODUCTIVITY OF SOME WHEAT CULTIVARS AS INFLUENCED BY BIOFERTILIZER APPLICATION UNDER DIFFERENT SEEDING RATES

Abouzar Dahdar, Nasir Parhizgar
ESTIMATING SINGLE LOST DIGITAL VIDEO FRAME VIA LINEAR AUTO-REGRESSIVE FILTERS IN TIME DOMAIN

Reni Hiola, Rama Hiola
ADAPTIVE REGRESSION SPLINE APPROACH ON COMPLAINTS EYE FATIGUE CRAFTSMEN MAKARAWO IN GORONTALO PROVINCE

Nader Kochak Zale, Hasan Shahraki Pour, Samad Karimzadeh
THE STUDY OF EUROPEAN FOUNDATION FOR QUALITY MANAGEMENT (EFQM) WITH HUMAN RESOURCES APPROACH FOR DEVELOPMENT OF CHABAHAR FREE ZONE

Ahmed M. Halawa, Reham M. Amin
THE VALIDITY OF PROTECTIVE ROLE OF GINGER AGAINST CHRONIC ALUMINUM TOXICITY ON BUCCAL MUCOSA (Histological and Immunohistochemical Study on Albino Rats)

Samiyeh Khorasvi, Gholam Hossein Ghasemi
STRUCTURAL EQUATION MODELING OF THE EFFECTS OF STRATEGIC ALIGNMENT MATURITY (BETWEEN IT STRATEGY AND BUSINESS) ON LABOUR PRODUCTIVITY Case study: Knowledge-based companies of Pardis Science & Technology Park of Tehran

M. Parvaz, A. Aghamohab Hulghi
CHECKING CHANGES IN RAINFALL IN KHUZESTAN PROVINCE (YEARS OF 1972-2012)

Muhammad Aziz Majidi, Wisnu Ari Adi
CHARACTERIZATION OF SINGLE PHASE Ba0.6Sr0.4Fe12O19, Mn1.5Ti1.5O19 NANO PARTICLES AS FOR ELECTROMAGNETIC ABSORBER MATERIALS

INSTRUCTIONS FOR AUTHORS
MÜMBÜLFLER ÜÇÜN TÖLÜMAT

2ND ISSUE
CHARACTERIZATION OF SINGLE PHASE $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$ NANOPISTLES AS FOR ELECTROMAGNETIC ABSORBER MATERIALS

Muhammad Aziz Majdi1, Wisnu Ari Adi2

1Dept of Physics, Faculty of Mathematics and Natural Sciences, University of Indonesia, Kampus Baru UI, Depok,
2Centre for Science and Technology of Advanced Materials – National Nuclear Energy Agency
Kawasan Puspiptek, Setu, Tangerang Selatan, Banten (INDONESIA)
E-mails: aziz@ui.ac.id, dwisnuad@batan.go.id

DOI: 10.7813/2075-4124.2015/7.3-4/A.50

Received: 15 Nov, 2014
Accepted: 17 Feb, 2015

ABSTRACT
A nanoparticle $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$ was successfully synthesized by solid state reaction through mechanical milling method. Stoichiometric quantities of analytical-grade MnCO3, BaCO3, Fe2O3, TiO2 and SrCO3 precursors were finely mixed and then milled for 10 hours in a planetary ball mill. The milled powder was then kept for 24 hours to obtain powder-based nanoparticles. The refinement of x-ray diffraction trace for re-milled materials confirmed a single phase material with a hexagonal structure of lattice parameters: $a = b = 5.878(1)$Å and $c = 23.082(8)$Å. The first mechanical milling resulted in powders with mean size 836 nm. The mean particle size was reduced further to 61 nm in the second mechanically milled powders. Results of neutron crystallography size evaluation for respective powder materials showed almost similar mean crystallite size about 15 nm. In addition, the hysteresis curve showed that the sample is ferromagnetic. Results of VNA evaluation indicated that there were three of absorption peaks with reflection loss values $-15.0$ dB, $-10.0$ dB, and $-10.2$ dB at frequency 9.0 GHz, 12.5 GHz, and 15.0 GHz respectively. The study concluded that the $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$ material with nanoparticles has been successfully synthesized showing a good candidate for electromagnetic absorber materials.

Key words: nanoparticle, $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$, crystallite size, particle size, electromagnetic, absorber material

1. INTRODUCTION
Barium-strontium hexa-ferites with a chemical formula of $\text{Ba}_{1-x}\text{Sr}_x\text{Fe}_{1-x}\text{Mn}_x\text{TiO}_3$ have a much larger uniaxial anisotropy constant and high saturation magnetization values and hence potential for permanent magnet applications [1-4]. Since the compounds are made of oxide based materials and they have high permeability value, ferrites are the most potential candidates as electromagnetic wave absorbing materials especially at high frequencies range such as radar absorbing material [5-7].

Recently, some magnetic materials including hexa-ferite based materials have been found to exhibit characteristics of microwave absorption [8-10]. They have been shown to be excellent candidate for microwave absorbing materials due to a high magnetization value. However, hexa-ferites such as barium-strontium hexaferrite has a relatively high anisotropy constant value and hence a high coercivity. Thus, more suitable as permanent magnets [11] instead of as absorbing materials because the interaction between magnetic moment and the magnetic field of microwave would not easy to take place. It is therefore some intrinsic properties of its magnetic phase like the anisotropy of its magnetic constant which govern the coercivity value has to be reduced. Reduction in anisotropy constant of barium-strontium hexaferrite modification is primarily required since a substantially low coercivity while the magnetisation remains high are the most properties that required for microwave absorber applications. At this study has shown that the magnetic coercivity was reduced very significantly in Mn and Ti substituted barium-strontium hexaferrite. In addition, the influence of fine particle size especially in nano size regime is also well known to affect both remanence and coercivity in this material [12-13].

The purpose of this study was to investigate the magnetic properties which exhibited by strontium (Sr) substituted barium (Ba) and manganese (Mn)-titanium (Ti) substituted iron (Fe) in $\text{BaFe}_{13}\text{O}_{19}$ structure. The study included synthesized nanoparticles for this composition and the microwave absorption performance for this material.

2. MATERIALS AND METHODS
A $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$ composition was prepared by solid state reaction using a conventional milling technique. Stoichiometric quantities of analytical-grade MnCO3, BaCO3, Fe2O3, TiO2 and SrCO3 precursors with a purity of greater than 99% were mixed and milled using a high-energy milling (HEM) type Spex 8000 to a powder weight ratio of 10:1 for 10 hours. The sample powders were then compacted into pellets and sintered in the electric chamber furnace at 1000°C for 10 hours to obtain crystalline materials. The $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.5}\text{Mn}_{1.5}\text{Ti}_{1}\text{O}_{10}$ sample was re-milled for 20 hours to obtain nanoparticles powders. The sample was characterised by powder x-ray diffraction (XRD) using a Rigaku Diffractometer with Cu Kα radiation ($\lambda = 1.5406$ Å). Powders obtained after 20 hours of re-milling time were found to be highly deformed materials, as indicated by the absence of Bragg diffraction peaks and the presence of broad and diffuse peaks by XRD analysis. Additional XRD analysis was performed to determine the mean crystallite size. In this case, un-overlapping diffracted peaks were selected, and reliable line-broadening data were obtained using the step-scanning mode. Intensity data were recorded for each 0.2° step using a 2-second scanning time, and the mean crystallite size was derived from Williamson-Hall formula [14] that takes into account the instrumental broadening correction and the correction due to lattice strain. The re-milled powders were then dispersed in distilled water and evaluated using a Helios sympatec particle size analyzer for micron-sized particles and a Zeta nanometer analyzer for nano-sized particles. Microstructural examination of the samples observed using the transmission electron microscope (TEM). The magnetic properties were evaluated using an Oxford instrument.
vibrating sample magnetometer (VSM). Finally, the reflection and transmission of microwave were carried out using the vector network analyzer (VNA) with frequency range of 300 kHz - 20 GHz.

3. RESULTS AND DISCUSSION

The x-ray diffraction profiles of synthesized material is shown in Figure 1 in which respective profiles of Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$ before and after milling (nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$) are compared. It is shown that the two diffraction profiles exhibit a pattern similar to that of BaFe$_2$O$_4$ phase despite a small shift in the peak positions due to the presence of a partial Sr ion substitution for Ba, in addition to Mn and Ti ion substitutions for Fe. Thus, the material is a single phase [4]. In addition, all XRD traces consistently exhibit diffraction line broadening.

![Fig. 1. The XRD profiles of synthesized material](image1.png)

![Fig. 2. Phase identification of XRD profile](image2.png)

The phase identification result of XRD profile of a nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$ is shown in Figure 2. The refinement result of XRD profile of a nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$ is shown in Figure 3. The resulting profile of the residue shows almost no intensity over the entire diffraction angle range. The quality factors of fitting R (criteria of fit) and χ² (goodness of fit) were considered acceptable. It was found that the χ² is less than 1.3 for nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$. Figure 3 showed that the profile is then in a good agreement between observation and calculation. The refinement results of x-ray diffraction pattern confirmed that the nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$ is a single phase material with a hexagonal structure. space group of P 63/m m c (194).

![Fig. 3. The refinement of XRD profile on a nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$](image3.png)

The unit cell parameters for the phase in nanoparticle Ba$_2$Sr$_2$Fe$_8$Mn$_{15}$Ti$_3$O$_{45}$ sample are summarized as shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Structure parameter, factor R and goodness of fit (χ²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nanoparticle Ba$_2$Sr$_2$Fe$<em>8$Mn$</em>{15}$Ti$<em>3$O$</em>{45}$</strong></td>
</tr>
<tr>
<td>Space group: P 63/m m c (194)</td>
</tr>
<tr>
<td>a = 5.878(1) Å, b = 5.878(1) Å and c = 23.082(3) Å, α = β = 90° and γ = 120°,</td>
</tr>
<tr>
<td>V = 690.54(4) Å³ and ρ = 5.850 g/cm³.</td>
</tr>
<tr>
<td>R factor</td>
</tr>
<tr>
<td>Fg = 2.13</td>
</tr>
</tbody>
</table>

Further confirmation was measuring the elemental analysis and observation of surface morphology on the samples to determine the particle distribution, homogenous, and its composition by using SEM-EDS equipment.
The elemental analysis and observation of surface morphology of the nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) showed that the sample has been well established as shown in Figure 4.

**Fig. 4. Surface morphology and elemental analysis of the nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \)**

The microstructure analyses showed that the particle shapes was aggregates with the varied particle sizes, uniform and evenly distributed on the surface of the sample. So that required further analysis of the element content in the samples use energy dispersive spectroscopy. The elements content of the nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) was shown in Table 2.

**Table 2. The results of element analysis by using energy dispersive spectroscopy**

<table>
<thead>
<tr>
<th>No.</th>
<th>Element</th>
<th>Content (wt%)</th>
<th>Content (at%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Barium (Ba)</td>
<td>6.21 ± 0.38</td>
<td>1.71</td>
</tr>
<tr>
<td>2</td>
<td>Strontium (Sr)</td>
<td>3.07 ± 0.26</td>
<td>1.05</td>
</tr>
<tr>
<td>3</td>
<td>Iron (Fe)</td>
<td>48.79 ± 0.26</td>
<td>26.17</td>
</tr>
<tr>
<td>4</td>
<td>Manganese (Mn)</td>
<td>8.27 ± 0.25</td>
<td>4.48</td>
</tr>
<tr>
<td>5</td>
<td>Titanium (Ti)</td>
<td>5.07 ± 0.16</td>
<td>2.63</td>
</tr>
<tr>
<td>6</td>
<td>Oxygen (O)</td>
<td>29.09 ± 0.08</td>
<td>62.16</td>
</tr>
</tbody>
</table>

Energy dispersive spectroscopy (EDS) spectra shows that the sample had composition in accordance to stoichiometry composition.

The mean crystallite size of \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) and nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) was calculated by the analysis method Williamson Hull of x-ray diffraction pattern [14]. The plot between values of B, Cos θ and Sin θ for \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) and nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) were given in Figure 5. The plot was a linear graph from which the mean crystallite size for respective samples was calculated. It is found that the mean crystallite size for \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) and nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) are 137 nm and 15 nm respectively. Thus, it is confirmed that both samples have a similar mean crystallite size value and re-milling of sintered powders would not change the size of crystallites containing in the particles.

**Fig. 5. The crystallite size of the samples**

In addition to the mean crystallite by x-ray line broadening analysis, the typical particle size distribution for \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) and nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) subject to nano size evaluation is demonstrated in Figure 6. The mono modal curves for the two samples indicated that the suspended particles in the dispersant media are homogeneous. However, the powders of nanoparticle \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) showed a narrower particle size distribution with the mean particle size of ~ 81 nm which is clearly much smaller than that of \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) (~ 836 nm). It is then concluded that re-milled \( \text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{0.9}\text{Mn}_{0.1}\text{Ti}_{0.5}\text{O}_{19} \) powders with an extended milling time up to 20 hours has refined the particle sizes from ~ 836 nm to ~ 81 nm that is one tenth of the original size. Re-milling the sintered powders is to refine the particles toward nanoparticles that is the particles containing nanocrystallites.
Fig. 6. Particle size distribution of the samples

A TEM micrograph of a synthesized nanoparticle \( \text{Ba}_{11.5}\text{Sr}_{2.5}\text{Fe}_{40}\text{Mn}_{10}\text{Ti}_{10}\text{O}_{100} \) powders is shown in Figure 7.

Fig. 7. The TEM photographs of nanoparticle \( \text{Ba}_{11.5}\text{Sr}_{2.5}\text{Fe}_{40}\text{Mn}_{10}\text{Ti}_{10}\text{O}_{100} \).

The image reveals the morphology and size of nanocrystals and the presence of particles that exist as aggregates of fine grains. It is clear that the additional milling of sintered mechanically alloyed powders is quite effective, not only in reducing the particle size, but also in changing the shape of the particles and producing a significant improvement in their size distribution. The average particle size which estimated from the TEM micrograph of Figure 7 was around ~80 nm which very close to the mean particle size subject to a nano sizer evaluation (~81 nm). The mechanical alloying of material precursors has resulted in laminated powders containing embryos of \( \text{BaFe}_{12}\text{O}_{19} \) phase. An additional treatment in form of sintering at a temperature 1000 °C to the mechanically alloyed powders has promoted the formation of crystalline particles with the mean particle size ~ 835 nm. The particles contained crystallites of mean size ~81 nm. A further milling of sintered nanoparticle \( \text{Ba}_{11.5}\text{Sr}_{2.5}\text{Fe}_{40}\text{Mn}_{10}\text{Ti}_{10}\text{O}_{100} \) powders during 24 hrs has refined further the mean particle size to ~137 nm which is very close to the size of mean crystallite sizes (~15 nm).

One of research topic in this area is the materials that can absorb electromagnetic waves that are can effectively reduced the reflection of electromagnetic signals. There are at least two important conditions must meet the requirements for a suitable and high performance absorbing material. The first is the so-called matched characteristics impedance as shown in Figure 8. Basically, the intrinsic impedance of the material must be equal to the intrinsic impedance of the free space. Second, the interaction between electromagnetic energy and material should results in a rapid attenuation of the incident electromagnetic, thus reducing the emerging wave to an acceptably low magnitude. It is therefore believed that materials with possesses dielectric and magnetic behavior would be the most potential candidates as absorbing materials.
Figure 9 shows the relation between the reflectance (RL) of nanoparticle $\text{Ba}_2\text{Sr}_2\text{Fe}_{6}\text{Mn}_1\text{Ti}_1\text{O}_{19}$ and the microwave frequency in range of 9-15 GHz, whose value of the absorbing peaks are -15 dB at 9.0 GHz, -10.0 dB at 12.5 GHz and -10.2 dB at 15.0 GHz.

4. CONCLUSIONS

The synthesized of $\text{Ba}_2\text{Sr}_2\text{Fe}_{6}\text{Mn}_1\text{Ti}_1\text{O}_{19}$ nanoparticle has successfully been made. Nanoparticles formation was confirmed by results of particle and crystallite analysis which confirmed by TEM images. The sintering treatment at a temperature 1000 °C to the mechanically alloyed powders has promoted the formation of crystalline particles with mean particle size ~ 835 nm. The particles contained crystallites of mean size ~ 137 nm. A further milling of sintered $\text{Ba}_2\text{Sr}_2\text{Fe}_{6}\text{Mn}_1\text{Ti}_1\text{O}_{19}$ powders during 20 hours has refined further the mean particle size to ~ 81 nm which is very close to the size of mean crystallite sizes (~ 15 nm). As to microwave properties the nanoparticle $\text{Ba}_2\text{Sr}_2\text{Fe}_{6}\text{Mn}_1\text{Ti}_1\text{O}_{19}$ has indicated certain microwave absorbing properties in the frequency range of 9-15 GHz, whose value of the absorbing peaks are -15 dB at 9.0 GHz, -10.0 dB at 12.5 GHz and -10.2 dB at 15.0 GHz.

ACKNOWLEDGEMENT

We are thankful for the financial support provided by the National Higher Education under the research grant Hibah Utama, Principal Investigator: Muhammad Aziz Majdi, Ph.D.

REFERENCES