CERAMIC GAS AND MAGNETIC SENSOR MATERIALS RESEARCH GROUP

TIER 5 – EK GROUP (EK)

Name of EK	**:**	**Ceramic Gas and Magnetic Sensor Materials Research Group**
Tier	**:**	**5**
Leader	**:**	**Dr. Misbah Bin Hassan**
CoRe	**:**	**Frontier Materials & Industrial Application (FMIA)**
Registered Faculty	**:**	**Faculty of Applied Sciences**
Registration date (Senate Approval)	**:**	**2014**
UiTM Niche Area	**:**	**Chemicals and Advanced Materials (W)**
EK Niche Area	**:**	**Spintronic –based manganites for future magnetic sensor element** **Novel oxide materials : Ceramic gas sensor element**

BACKGROUND OF MEMBERS

BIL	NAMA	KELAYAKAN AKADEMIK	FAKULTI	BIDANG KEPAKARAN
1	DR. MISBAH HASSAN	PhD	Fakulti Sains Gunaan	Superconductor & Novel Oxides (Gas sensor)
2	DR. NORAZILA BINTI IBRAHIM	PhD	Fakulti Sains Gunaan	Advanced material : Magnetic Material /Magnetic sensor
3	PUAN SURAYA BT AHMAD KAMIL	MASTER IN PHYSICS (CB)	Fakulti Sains Gunaan	Semiconductor
4	EN.FAUZI BIN MAULUD	MASTER IN PHYCIS	Fakulti Sains Gunaan	Superconductor & Novel Oxides
5	EN.HAFIZI BIN LUKMAN	MASTER OF ENGINEERING (MECHANICAL)	Fakulti Kejuruteraan Mekanikal	Dynamics and Vibrations

DR MISBAH HASSAN (HEAD)

EN. MOHD FAUZI BIN MAULUD

DR NORAZILA BINTI IBRAHIM

PUAN SURAYA BT AHMAD KAMIL (CB)

EN .HAFIZI BIN LUKMAN

CGMSM ACHIEVEMENT(2015-2017)

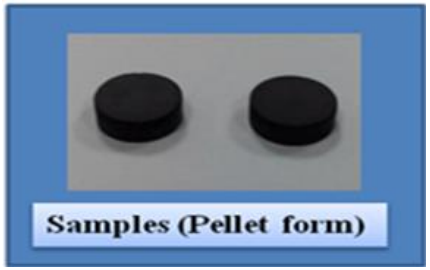
PENCAPAIAN	2015	2016	2017
Master Degree – Enrolled/On-Going	6	6	6
Master Degree - Graduated		1	-
PhD – Enrolled/On-Going	1	1	1
PhD – Graduated	-	-	-
No. of research grants	7	3	3
Total value of research grants (RM)	418,900	418,900	418,900
Total publication (Indexed Journals)	-	2	1
Total publication (Non-indexed Journals)	-	-	-
IPR (Patent, Industrial design, Copyright)	-	-	-

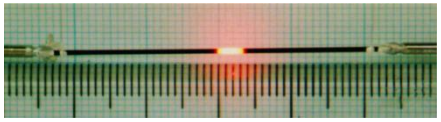
OTHER ACHIEVEMENT FMMI (2015-2017)

ACHIEVEMENT	2015	2016	2017
NO. OF CONSULTANCY/ INDUSTRIAL LINKAGE/ COLLABORATION (National & International)	-	-	-
NO. OF MEMBERSHIP OF PROFESSIONAL BODIES AND ASSOCIATIONS (National & International)	3 -MASS -BOARD OF ENGINEER	3 -MASS -BOARD OF ENGINEER	3 -MASS -BOARD OF ENGINEER
NO. OF SPECIAL INVITATION/ APPOINTMENT/ EXPERTISE (National & International) incl. Keynote Speaker, Invited speaker, Thesis examiner, Judge, Reviewer, Panel, etc.)	5	8	8
NO. OF AWARDS/ RECOGNITION AND APPRECIATION (National & International)	-	1	-

Ceramic Gas and Magnetic Sensor Materials Research Group

(CGMSM) is formed to foster research on physical properties of novel oxide materials and magnetic materials which relevant for their potential applications.



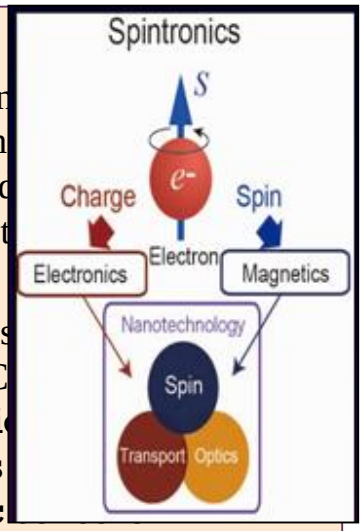


1. Magnetic Sensor Materials

The emergence of spintronic technology is based on man spin to sense magnetic field. Currently, the large ch observed in presence of magnetic field in some semicond materials called Giant Magnetoresistance (GMR) lead t spintronic-based devices.

The change in resistivity due to magnetic field was als manganites material called Collosal Magnetoresistance (C

To elucidate the exchange mechanism, electri properties of selected electron doped manganites for potential technological applications as magnetic



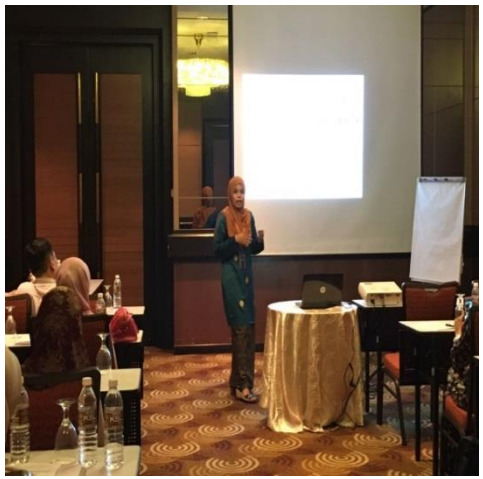
2. **Gas Sensor: Development of ceramic oxygen sensor**:
The mechanism of hot spot formation upon application of external voltage has been explain in terms of joule heating due to large voltage drop as a result of large increase in resistivity. The hot- spot based RE123 oxygen sensing (self heating oxygen sensor) are now being explored without some form of external heating to detect oxygen gas. After the appearance of a hot spot, sensor current strongly depended on the oxygen partial pressure at a particular selected voltage and flow rate of the gas.

- **Many activities emphasize on the following areas:**

1. **Synthesis** : Fabricated magnetic sensor elements and gas sensor materials as well as to analysis of the electrical as well as magnetic properties based on experimental and the theoritical framework
2. **Characterization** : Investigation on the performance of the studied material as a sensor element
3. **Enhance Scientific knowledge**: To enhance knowledge of the possible mechanism involved on the observed properties
4. **Knowledge and technology transfer** to clients/researcher/ collaborators includes problem solving : Through research activity, training and consultant.

CGMSM Research Activities

Conferences

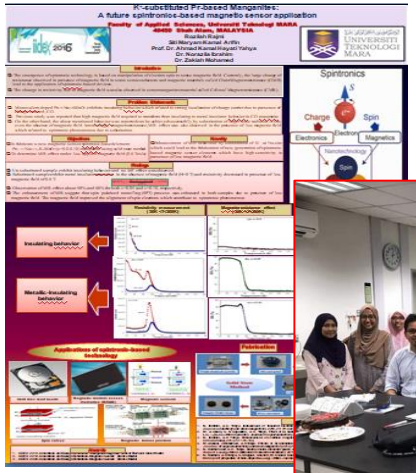


Best Poster Award Presentation : 2016

IIDEX 2016

GROUP PRESENTATION

RESEARCH TRAINING



LAB VISITING

Physica B 521 (2017) 281–294

Contents lists available at ScienceDirect

Physica B

journal homepage: www.elsevier.com/locate/physb

Inducement of ferromagnetic-metallic phase in intermediate-doped charge-ordered $Pr_{0.75}Na_{0.25}MnO_3$ manganite by K^+ substitution

R. Rozilah[a], N. Ibrahim[a], Z. Mohamed[a], A.K. Yahya[a,*], Nawazish A. Khan[b], M. Nasir Khan[c]

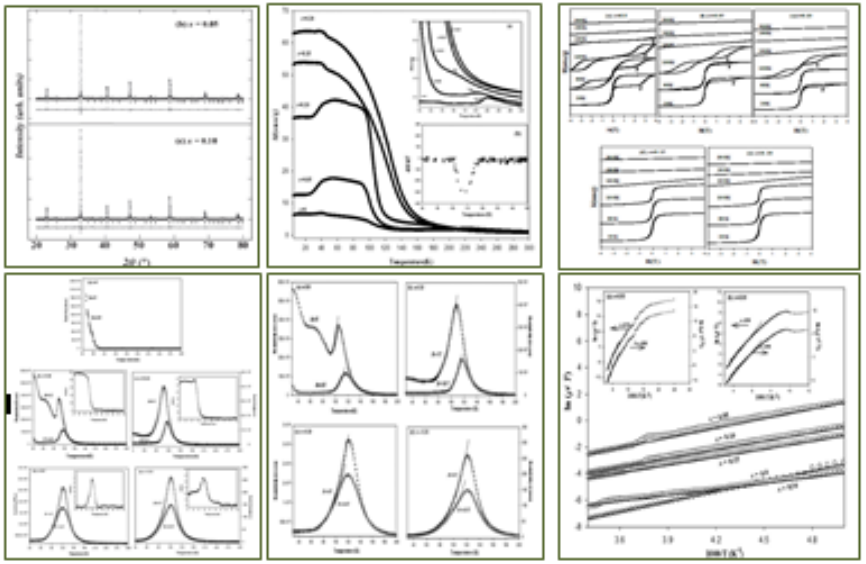
[a] Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[b] Materials Science Laboratory, Department of Physics, Quaid-I-Azam University, 45320 Islamabad, Pakistan
[c] Physics Division, PINSTECH, P.O. Nilore, 45600 Islamabad, Pakistan

ARTICLE INFO

Keywords:
Manganites
Charge-ordered
Magnetic properties
Electrical properties
Magnetoresistance

ABSTRACT

Polycrystalline $Pr_{0.75}Na_{0.25-x}K_xMnO_3$ (x = 0, 0.05, 0.10, 0.15 and 0.20) ceramics were prepared using conventional solid-state method and their structural, magnetic and electrical transport properties were investigated. Magnetization versus temperature measurements showed un-substituted sample exhibited paramagnetic behavior with charge-ordered temperature, T_{CO} around 218 K followed by antiferromagnetic behavior at transition temperature, $T_N \sim 170$ K. K^+-substitution initially weakened CO state for x = 0.05–0.10 then successfully suppressed the CO state for x = 0.15–0.20 and inducing ferromagnetic-paramagnetic transition with Curie temperature, T_C increased with x. In addition, deviation of the temperature dependence of inverse magnetic susceptibility curves from the Curie-Weiss law suggests the existence of Griffiths phase-like increased with x. Magnetization versus magnetic field curves show existence of hysteresis loops at $T < 260$ K (x = 0) and $T < 180$ K (x = 0.05–0.10), which related to metamagnetic transition occurring at critical field. Electrical resistivity measurements showed an insulating behavior for x = 0 sample while for x = 0.05–0.20 samples showed metal-insulator transition and transition temperature, T_{MI} increased with x. The increased in T_C and T_{MI} are attributed to the increase in tolerance factor which indicates reduction in MnO_6 octahedral distortion consequently enhanced double exchange interaction.



Impact Factor :
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Q 2/Q3

J Supercond Nov Magn (2016) 29:911–922
DOI 10.1007/s10948-015-3346-5

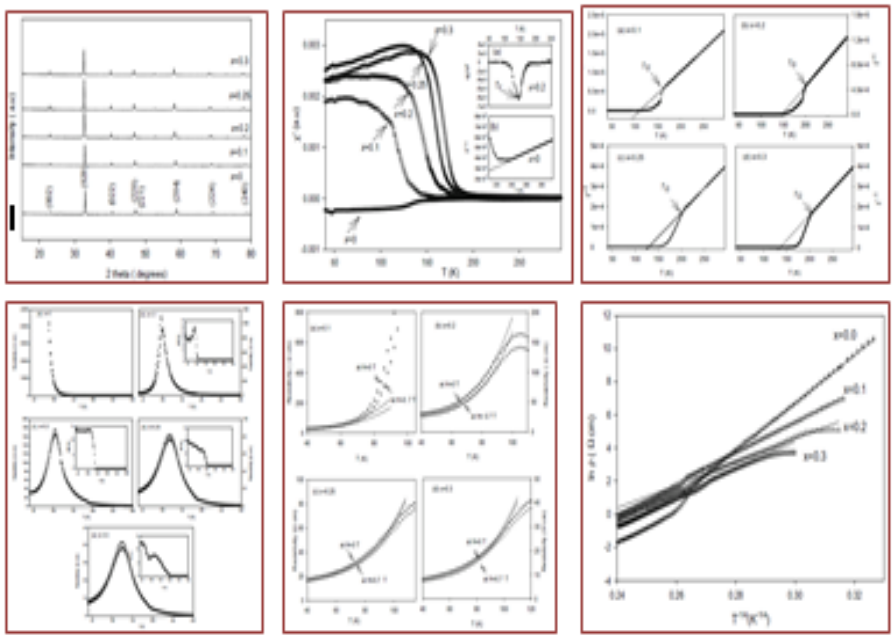
ORIGINAL PAPER

Impact Factor :
1.18 (2016)
Q 3

Inducement of Itinerant Electron Transport in Charge-Ordered $Pr_{0.6}Ca_{0.4}MnO_3$ by Ba Doping

N. Ibrahim[1] · A. K. Yahya[1]

Abstract The effects of Ba^{2+} doping on the electrical and magnetic properties of charge-ordered $Pr_{0.6}Ca_{0.4}MnO_3$ were investigated through electrical resistivity and AC susceptibility measurements. X-ray diffraction data analysis showed an increase in unit cell volume with increasing Ba^{2+} content indicating the possibility of substituting Ba^{2+} for the Ca-site. Electrical resistivity measurements showed insulating behavior and a resistivity anomaly at around 220 K. This anomaly is attributed to the existence of charge ordering transition temperature, T_{CO}^{R} for the $x = 0$ sample. The Ba-substituted samples exhibited metallic to insulator transition (MI) behavior, with transition temperature, T_{MI}, increasing from ~98 K ($x = 0.1$) to ~122 K ($x = 0.3$). AC susceptibility measurements showed ferromagnetic to paramagnetic (FM-PM) transition for Ba-substituted samples with FM-PM transition temperature, T_c, increasing from ~121 K ($x = 0.1$) to ~170 K ($x = 0.3$), while for $x = 0$, an antiferromagnetic to paramagnetic transition behavior with transition temperature, T_N, ~170 K was observed. In addition, inverse susceptibility versus T plot showed a deviation from the Curie–Weiss behavior above T_c, indicating the existence of the Griffiths phase with deviation temperature, T_G, increasing from 160 K ($x = 0.1$) to 206 K ($x = 0.3$).



Paper under Review : on line submission

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Journal of Superconductivity and Novel Magnetism

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Submissions Being Processed for Author Norazila Ibrahim, Ph.D

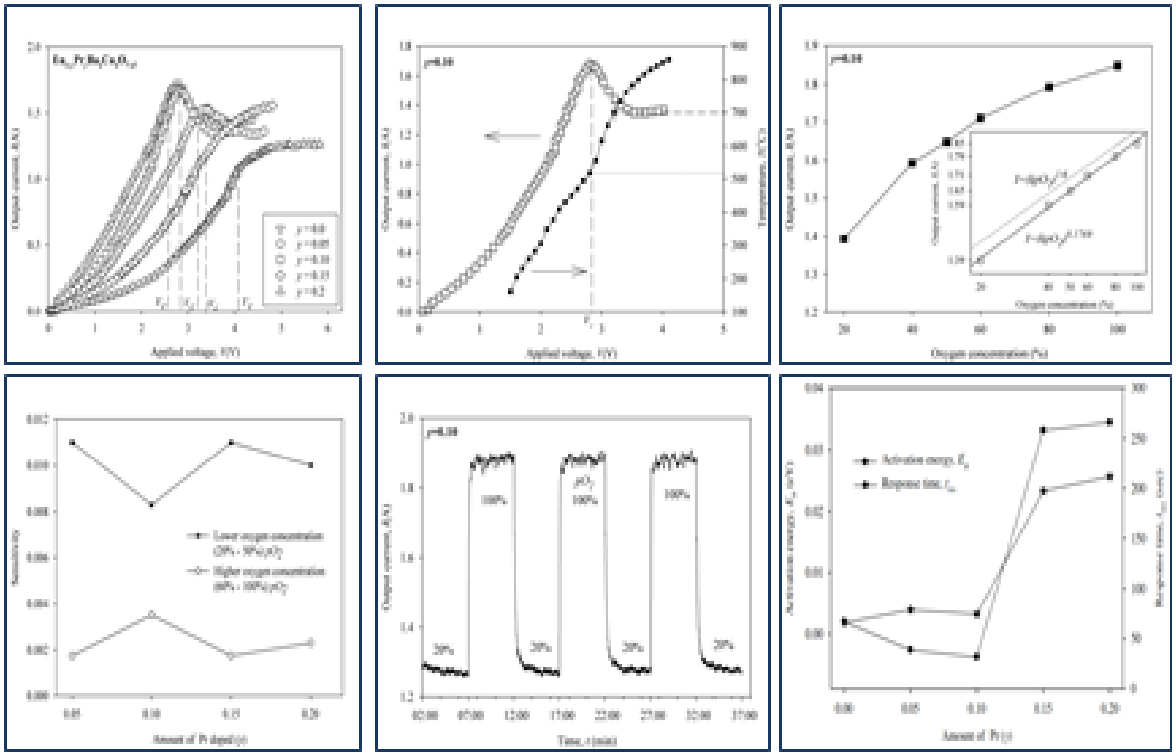
Page: 1 of 1 (1 total submissions) Display 10 results per page.

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links	JOSC-D-17-00861	Revival of Metal-Insulator and Ferromagnetic -Paramagnetic Transitions by Ni Substitution at Mn-Site of Charge Ordered Monovalent Doped Nd0.75Na0.25MnO3 Manganites	16 Oct 2017	21 Oct 2017	Under Review

Page: 1 of 1 (1 total submissions) Display 10 results per page.

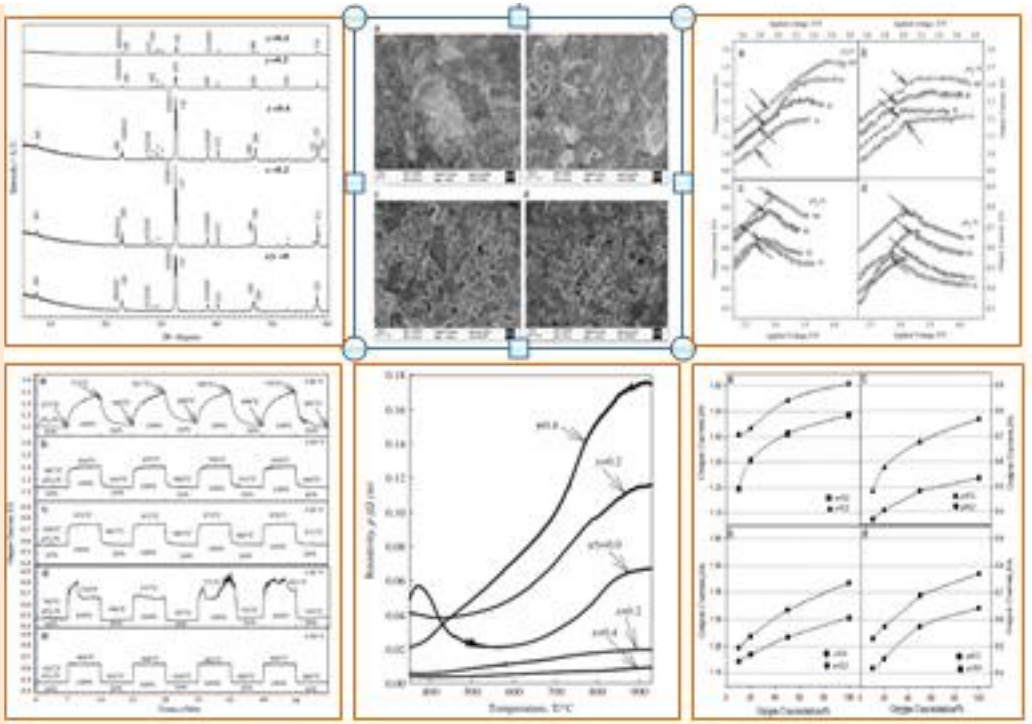
In this study, $Eu_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ (x = 0.05, 0.10, and 0.20) ceramic rectangular rods were prepared by the solid-state reaction method to investigate the effect of Pr doping on oxygen sensing behaviours. X-ray powder diffraction analysis showed all rods were orthorhombic in structure with reduction in orthorhombicity upon doping. For all samples, the *I-V* curve showed a relatively constant output current after the appearance of hot-spot. The magnitude of the constant output current was observed to be decreasing with increasing Pr doping which indicates possible reduction in intrinsic hole concentration. In addition, the output current for rods with x = 0.0, 0.05 and 0.10 showed a sudden drop upon the appearance of hot-spot, due to the sudden increase in hot-spot temperature, before becoming slightly constant. Interestingly, the output current after appearance of hot-spot for all rods showed strong dependency on ambient oxygen concentration. The sensitivity for each rod, however, reduces with increasing ambient oxygen concentration. The doping seems to prevent the sensitivity from dropping to almost zero as was previously reported for $Eu(Ba_{1-y}Pr_y)_2Cu_3O_{7-\delta}$ rods due to existence of Cu-O chains in the orthorhombic structure. Pr doping (for x = 0.10) has

Oxygen sensing behaviour of Pr doped ceramic rods with hot-spot



Effect of divalent ion substitution on oxygen sensing properties of hot-spot based $Eu_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ and $Eu_{1-y}Mg_yBa_2Cu_3O_{7-\delta}$ ceramics

In this paper effects of Ca and Mg substitution on oxygen sensing properties of hot spot based Eu123 rods are reported. $Eu_{1-x}Ca_xBa_2Cu_3O_{7-\delta}$ (x = 0.2–0.5) and $Eu_{1-y}Mg_yBa_2Cu_3O_{7-\delta}$ (y = 0.2–0.5) ceramics were synthesized from oxide powders using the standard solid state method and fabricated into short rods. For Ca-substituted rods, after appearance of a visible hot spot, a constant current plateau in *I–V* curve was formed. The output current response of the rod in periodically changing pO_2 between 20% and 100% showed improved stability and reproducibility for x = 0.4 compared to x = 0.2. Improved oxygen absorption and desorption time was observed for x = 0.4 compared to previously reported un-substituted rod. On the other hand, for Mg-substituted rods the *I–V* behavior after formation of hot spot showed a negative slope. Faster absorption time of 3.0s and desorption time of 6.9s were observed for y = 0.4 compared to y = 0.2. The improved output current stability, reproducibility and response time is suggested to be due to changes in oxygen activation energy and increased hole concentration as a result of Ca^{2+}/Mg^{2+} substitutions. The Mg-substituted rods showed better performance compared to Ca-



List of papers presented during conferences (2016)

1. ***Effect of Cr^{3+} substitution at Mn-site on electrical properties and magnetoresistance behavior of $Bi_{0.3}Pr_{0.3}MnO_3$ (x= 0.00, 0.004, 0.1)***. **Norazila Binti Ibrahim,** Ahmad Kamal Yahya Persidangan Fizik Kebangsaan 2016: PERFIK 2016, 21-22 Disember 2016, Hotel Pullman, Kuala Lumpur, Malaysia. Organizer : Universiti Malaya and Institut Fizik Malaysia

2. ***Structural, Electrical Transport and Magnetoresistance Behaviour of Ru Doped $Nd_{0.75}Na_{0.25}Mn_{1-x}Ru_xO_3$ (x= 0.00, 0.05, 0.07) Manganites***. **NORAZILA BINTI IBRAHIM*,** MARYAM ZAINAL AFIRFIN, NUR ALYA AMIRAH BINTI ROSLI and AHMAD KAMAL YAHYA. 29th RCSSST2016 (Regional Conference on Solid State, Science and Technology), KSL Hotel Johor Bahru, Universiti Teknologi Malaysia (15-17 November 2016)

3. ***"Inducement of Ferromagnetic Metallic Phase by Ni Doping at Mn-Site of Charge Ordered Monovalent Doped Nd0.75Na0.25MnO3 Manganites"***.Siti Maryam*, **Norazila Ibrahim**, A. K. Yahya and Zakiah Mohamed. 29th RCSSST2016 (Regional Conference on Solid State, Science and Technology), KSL Hotel Johor Bahru, Universiti Teknologi Malaysia (15-17 November 2016)

4. ***Electrical and magnetic properties in charged-ordered monovalent-doped Pr0.75Na0.25-xKxMnO3 manganites***
ROZILAH RAJMI, AHMAD KAMAL HAYATI YAHYA *, **NORAZILA IBRAHIM** AND ZAKIAH BINTI MOHAMED, 29th RCSSST2016 (Regional Conference on Solid State, Science and Technology), KSL Hotel Johor Bahru, Universiti Teknologi Malaysia (15-17 November 2016).

List of papers accepted to be presented during conferences (2017) 13 & 14 Nov 2017 (The International Conference on Solid State and Science Technology)

1. Effect of Cr^{3+} Substitution At Mn-Site On Electrical and Magnetic Properties Of Charge Ordered $Bi_{0.3}Pr_{0.3}Ca_{0.4}MnO_3$ Manganites

Nor Asmira[1, a *], **N.Ibrahim**[2,b] Zakiah Mohamed[3,c] and A. K. Yahya[4,d]
[1]Faculty of Applied Sciences, University Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

*corresponding author: noraz954@salam.uitm.edu.my

2. Magnetic and Electronic Transport Properties of Electron doped Manganites $La_{0.9-x}Bi_xTe_{0.1}MnO_3$ Manganites (x = 0.00, 0.1)

N.Ibrahim, Zakiah Mohamed , A. K. Yahya, and Rozilah Rajmi
[1]Faculty of Applied Sciences, University Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

*corresponding author: noraz954@salam.uitm.edu.my

FUTURE PLANS:

- √ **Workshop** on magnetic characterization and related magnetic properties _ magnetic sensor element
- √ **Collaboration** with others researchers / industry–fabrication magnetic sensor element in thin film and its characterization
- √ **Lab open day** : to share about research activity with others such as final year students/ student from others school/
- √ Increase the number of post grad students
- √ Apply budget / grant :
- √ **Training** : New technique of characterizations / enhance skill in research or other related technique on fabrication of sensors element
- √ **Expanding networking ; with others collaborators :**