

CELEBRATING
COMMERCIALISATION
YEAR 2014

iiindex 2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

invention
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exposition 2014

INNOVATEUR
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2014

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UNIVERSITI TEKNOLOGI MARA
MALAYSIA

*Bridging
the valley of death :
advancing the
commercialisation
of research*

RESEARCH BOOK

iiindex2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

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FOREWORD

The Honourable Minister of Science, Technology and Innovation (MOSTI) has launched 2014 as Malaysia Commercialisation Year 2014 (MCY2014) with the theme Science Technology and Innovation (STI) for Wealth Creation. In line with this theme, Invention, Innovation, Design & Exposition 2014 (iidex2014) is an annual exposition organized by UiTM and is the ultimate platform to highlight and commercialise new inventions and innovations. Researchers and inventors will exhibit their products which cater to the needs and wants of the community and the country.

The iidex2014 creates a new dimension by fusing two competitive concepts, a competition among innovative products and a competition to invite Innovateur Wannabes to perform live pitching of their products to the audience. The iidex2014 focuses on comprehensive commercialization and creating opportunities for entrepreneurs to carry out R&D as well as to provide avenue to commercialise their products. Through expositions such as iidex2014, MOSTI hopes to inculcate the culture of commercialisation of new technology designed and created by Malaysians.

I wish to congratulate all the participants of the iidex2014 and this is the opportunity for all researchers to show their ideas and exhibits their products and creativity. Apart from showcasing their products, innovators will have the opportunity to provide a window to the industry for business matching during the exposition.

Tan Sri Dato' Sri Sallehuddin Mohamed
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Li_{2x}Mg(1-x)O LIGHT ABSORPTION PROPERTIES FOR SEMICONDUCTOR APPLICATIONS

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Substitution of cation in metal oxides could give different properties with potential in some application such as semiconductor. Li_{2x}Mg(1-x)O was prepared by substitution of magnesium with lithium in magnesium oxide to form new materials Li_{2x}Mg(1-x)O (x= 0.1, 0.2) which were Li_{0.2}Mg_{0.90} and Li_{0.4}Mg_{0.80}. Both MgO and Li_{2x}Mg(1-x)O were synthesized by using a sol-gel method. The samples were named M1 (MgO), M2 (Li_{0.2}Mg_{0.90}) and M3 (Li_{0.4}Mg_{0.80}). The samples were characterized by using X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). The band gap energies of the samples were obtained from measurements using a UV-Vis Spectrophotometer. The XRD patterns of lithium substituted samples are isostructural with the ICDD pattern of MgO (ICDD No. 01-074-1225). No impurity peaks could be observed. The peak positions are slightly shifted to the right as is illustrated by the shift of the (200) reflection and this is true with the other peaks as well. This implies that the cell parameters have decreased and it can only happen if the smaller ionic radius Li⁺ ions have been successfully substituted into the crystal lattice of the MgO. The ionic radii of the ions, Li⁺ and Mg²⁺, are 0.76 angstrom and 0.72 angstrom respectively according to coordination number 6 (cubic structure). Therefore, lithium can be said to have been successfully introduced into the crystal lattice of the material and the substitution reaction is deemed successful. It is observed that the average crystallite size of M2 and M3 samples are much bigger than although the annealing time and temperature is the same. This shows that the thermal characteristics of the Li_{2x}Mg(1-x)O are quite different from the pure MgO. The rate of crystal growth of the materials with more lithium content is higher as can be seen with the large crystallite size of highest lithium content sample (M3). Thus, the amount of lithium content in the samples seems to affect the rate of crystal growth. It was found that there were quite drastic differences in the band energies of MgO and Li_{2x}Mg(1-x)O materials. The band gap energy for MgO is 5.13 eV which is lower than conventional value (7.8eV) by about 34%. There are two absorption edges for the Li containing samples instead of just one as observed for the MgO sample. The edges have a gradual slope and this is very different from that of the absorption edge of MgO which has a distinctly sharp edge. The positions of the absorption edges are towards the lower wavelength region and correspond to band energies of 2.82 eV and 2.90 eV for first absorption edge and 1.83 eV and 1.98 eV for second absorption edge. These very different spectra observed for the Li substituted samples is another proof of the formation of new Li_{0.2}Mg_{0.90} and Li_{0.4}Mg_{0.80} compounds. Materials are uniquely characterized by their band gaps. It is observed that the larger the Li content the larger the band energies. The observed red shift may be because the presence of Li may have caused hybridization and introduced more energy levels in-between the MgO gap. The substituted materials, Li_{2x}Mg(1-x)O have band gaps of between 1.83 eV to 2.90 eV which make it usable as semiconductor materials.