

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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CONDUCTIVITY IMPROVEMENT OF CR DOPED AL₂O₃ MATERIALS

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Al₂O₃ is highly important in many fields of electronics and engineering due to its excellent chemical stability, good mechanical properties, and relatively low cost of manufacturing. It is known that Al₂O₃ is highly insulating with a large band gap of 8.8 eV. It is the choice insulator for magnetic tunnel junctions (MTJ), superconducting Josephson junctions (JJ) and metal oxide semiconductor (MOS). Not much work has been done on the electrical effect of substitutional doping of metal oxide insulators such as Al₂O₃. It is therefore interesting to study the effects of doping on the electrical characteristics of Al₂O₃. Al₂-xCr_xO₃ (ruby) exist naturally in the earth's crust and widely used for hydraulics, airflow filters, solid-state lasers, solar energy and is valued as a gemstone. A substitution reaction producing pure phase phases is not easy to achieve for this material due to the high formation temperature. It is known that Al₂O₃ is a very stable compound with high formation temperature of 2054 degree Celsius. Therefore, it will not be easy to synthesize pure and single phase Al₂-xCr_xO₃ materials, unless a suitable synthesis method is used and the thermal annealing is done at the correct temperature. This work focuses on the substitution of Al with Cr to produce Al₂-xCr_xO₃ materials (x = 0.1, 0.2, 0.3). A high Cr content in the synthesized Al₂-xCr_xO₃ materials was achieved via a new synthesis route, the self propagating combustion method, for investigation of the effect of Cr substitution on the electrical, optical band gap and structural characteristics of the modified Al₂O₃ materials. Our combustion synthesis method has successfully yielded a higher Cr content of 6 to 26% in the Al₂-xCr_xO₃ powders. This illustrates that the self propagating combustion method is a good synthesis method for producing doped Al₂-xCr_xO₃ materials. This simplest method not only can produce high yield purity material, but cost of synthesizing also low and just used a few starting materials. The X-Ray diffraction (XRD) results showed that all the samples were pure and that Cr was successfully substituted in the crystal lattice. The cell parameters and volume are linearly dependent on the Cr content. AC impedance spectroscopy results show that conductivity of the Cr doped samples increase exponentially with Cr content. The conductivities of the Al₂-xCr_xO₃ have been found to increase by the order of one in the highest Cr content sample, Al_{1.7}Cr_{0.3}O₃. It is also found that as the Cr content increases, band gap values decreases. This is a new and novel finding. This is attributed to band gap narrowing of the Al₂-xCr_xO₃ powders as obtained from UV-Visible spectrophotometric studies. The Al₂-xCr_xO₃ substituted materials have band gaps of between 4.49 to 4.90 eV, making it usable as semiconductor materials.