AUN/SEED-Net JICA

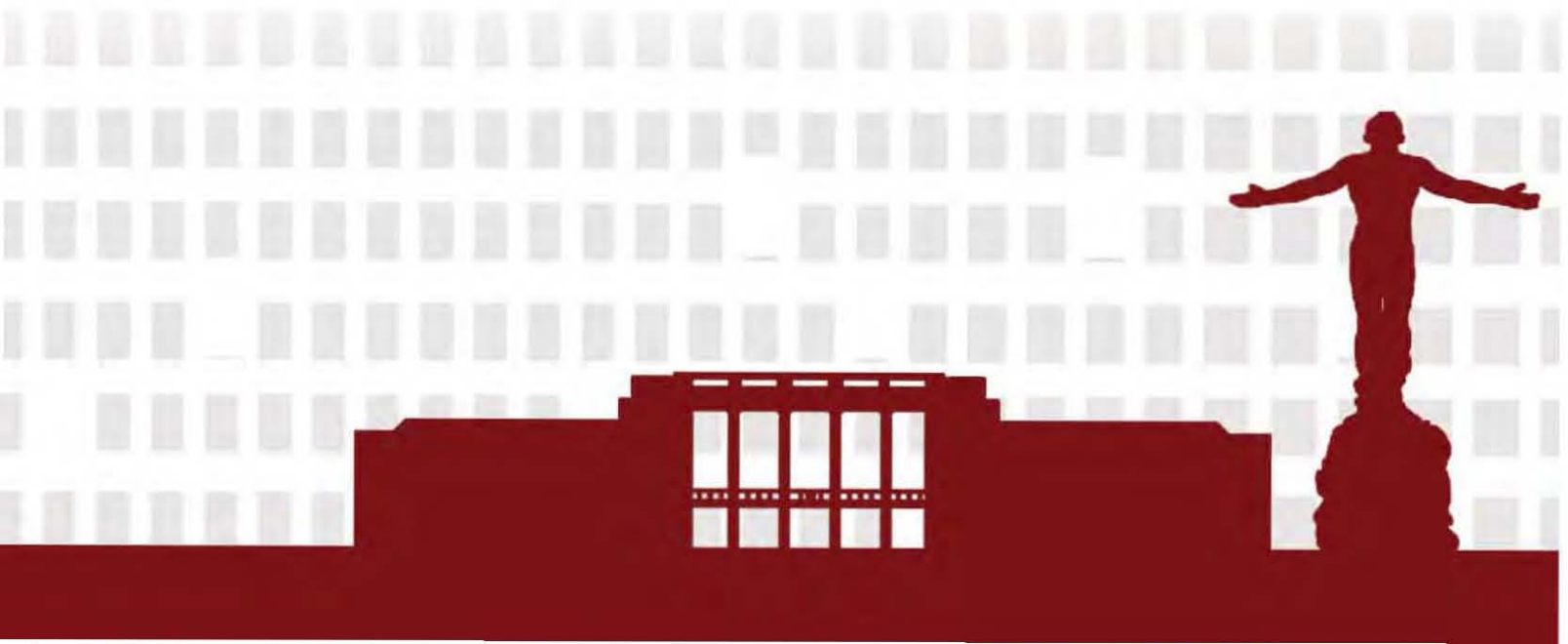
8th AUN/SEED-Net
REGIONAL CONFERENCE ON ELECTRICAL AND ELECTRONICS ENGINEERING

Envision, Enable, and Empower
Smarter and Resilient Societies

co-located with

11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology and Energy

16-17 November 2015
Metro Manila, Philippines



Proceedings of the 8th AUN/SEED-Net RCEEE 2015 and 11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology, and Energy

Editors:
Dr. Joel Joseph S. Marciano Jr.
Dr. Jhoanna Rhodette I. Pedrasa
Dr. Rhandley D. Cajote

ISBN: 978-616-406-075-3

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) JICA Project
Faculty of Engineering, Bldg. 2
Chulalongkorn University, Bangkok
Thailand 10330

Printed in the Philippines by: ERZALAN PRINTING PRESS
45 Cotabato Street, Luzviminda Village, Batasan Hills, Quezon City, Philippines

8th AUN/SEED-Net Regional Conference
on Electrical and Electronics Engineering 2015

co-located with

11th ERDT Conference
on Semiconductor and Electronics, Information and Communications Technology, and Energy

Envision, Enable and Empower Smarter and Resilient Societies

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) in partnership with Engineering Research and Development for Technology (ERDT) and University of the Philippines Diliman.

ISBN: 978-616-406-075-3

SYNTHESIS AND CHARACTERIZATION OF FLOWER-LIKE CUO NANOSTRUCTURES BY HYDROTHERMAL METHOD

Jenichi Clairvaux E. Felizco *, Michael R. Tan and Mary Donnabelle L. Balela

Department of Mining, Metallurgical and Materials Engineering,
University of the Philippines Diliman, Quezon City, PHILIPPINES.
* E-mail: jefelizco@upd.edu.ph

ABSTRACT

Nanostructured CuO has been gaining interest due to its unique properties, which are of potential use in a wide variety of applications such as superconductors, gas and chemical sensors, supercapacitors, photocatalysts and antimicrobial agents [1]. In this study, unique flower-like CuO nanostructures were successfully synthesized by a simple hydrothermal method in NH3 solution at low temperature. In a typical synthesis, 4 M aqueous Cu(NO3)2 solution was placed into a teflon lined autoclave. The solution pH was adjusted dropwise to 8, 10 and 12 using 25wt.% ammonia, then allowed to react for 6 h at 120°C. The samples were characterized using X-ray diffraction (XRD) and Scanning electron microscopy (SEM). The XRD patterns confirmed the presence of pure, highly crystalline monoclinic CuO at pH 10 and 12, as represented by the peaks at 32.5°, 36.3°, 39.4°, 49.4°, 54.3°, 59.7°, 62.3°, 66.8°, 68.9°, 75.82° corresponding to its 110,11-1, 111, 20-2, 020, 202, 11-3, 31-1, 220 and 004 facets (JCPDS 05-661). Low crystallinity and presence of Cu(OH)2 peaks at 36.4° and 43.5° in the sample obtained at pH 8 implies incomplete reaction. SEM images confirmed the presence of nanoleaves at pH 8, and nanoflowers at pH 10 and 12. Growth of these CuO nanostructures could have originated from the formation of CuO nuclei, which acted as seeds for oriented growth into lamellar structure. They preferentially orient to a specific plane due to high surface energy and electrostatic interaction, which results to the further formation from lamellar to flower-like structures as the reaction progresses. At lower pH, the amount of OH- is not sufficient to drive the reaction forward, so the presence of fewer CuO products led to the formation of nanoleaves. Increasing the pH resulted to the presence of more OH- ions, driving the reaction to completion, and to the formation of more complex flower-like structures. This facile synthesis method can potentially be used for large scale and low cost fabrication of CuO nanostructures for advanced applications.

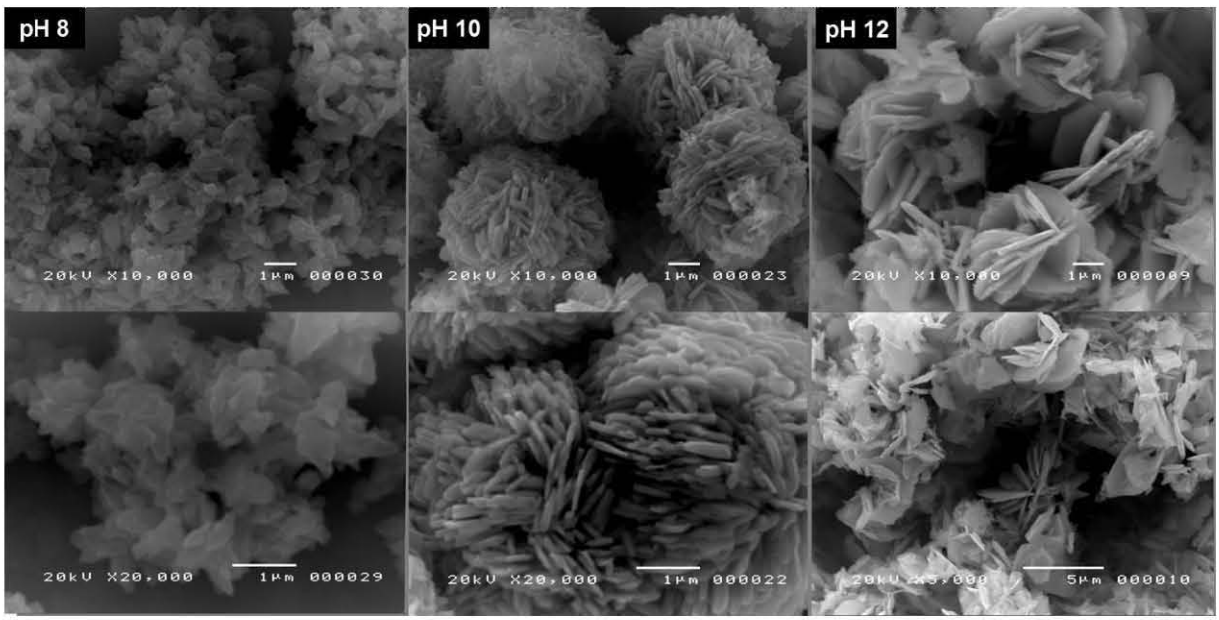


Figure 1. SEM Images of CuO products formed at pH 8, 10 and 12.