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The 3rd World Symposium on Materials Sciences and Engineering
The 2nd World Symposium on Intelligent System and Electronic Devices
The 2nd International Conference on Catalysis, Chemical Science and Technology

Time: Nov. 5th-8th, 2024

Place: Hilton Nagoya, Japan

Format: Hybrid

Conference Book

Title: Eco-Friendly Green Synthesis of Co^{2+} and Mn^{2+} ion Doped ZnO Nanoparticles for Silicon Solar cell Applications

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Abstract

Global warming is a threat for human health in context of the growing organic or inorganic pollutants, which are produced by diverse products output. Therefore, the green synthesis method successfully eradicates the harmful and/or toxic effects usually associated with wet chemical methods. Different concentrations (0, 1, 5 and 10 at%) of Co^{2+} and Mn^{2+} ion-doped ZnO nanoparticles (NPs) were synthesized by eco-friendly green synthesis method by exploiting dandelion leaf extract as a solvent at lower temperature 70 ℃ and annealed the NP at 600 ℃ for 3 h to grow the crystallinity of the NPs. The phase purity, crystal structure and crystallinity of the as-synthesized product was verified by XRD, showing hexagonal-Wurtzite phase structure. SEM and TEM images of the NPs demonstrated sub-100nm spherical shaped particles. Fourier transform infrared (FTIR) displays the band at 523 cm^{-1} is assigned to asymmetric stretching of the Zn – O tetrahedron. Both UV-Visible and photoluminescence studies confirm the near band edge emission of ZnO and successive incorporation of Co^{2+} and Mn^{2+} ion-doped ZnO host. In order to increase the efficiency of the solar cell power conversion on Polycrystalline silicon solar cells, different layers of Co^{2+} and Mn^{2+} ion-doped ZnO NPs coated on bare polycrystalline silicon are considered to be a promising strategy. Furthermore, solar cell efficiency decreases with further coating of NP layers and/or thickness. Optimum solar cell power efficiency was observed for 5%Mn ion doped ZnO NP with three layers. In addition, Radish and Cress plants grown using NP supernatant showed high environmental biocompatibility using Dandelion Leaf extract.

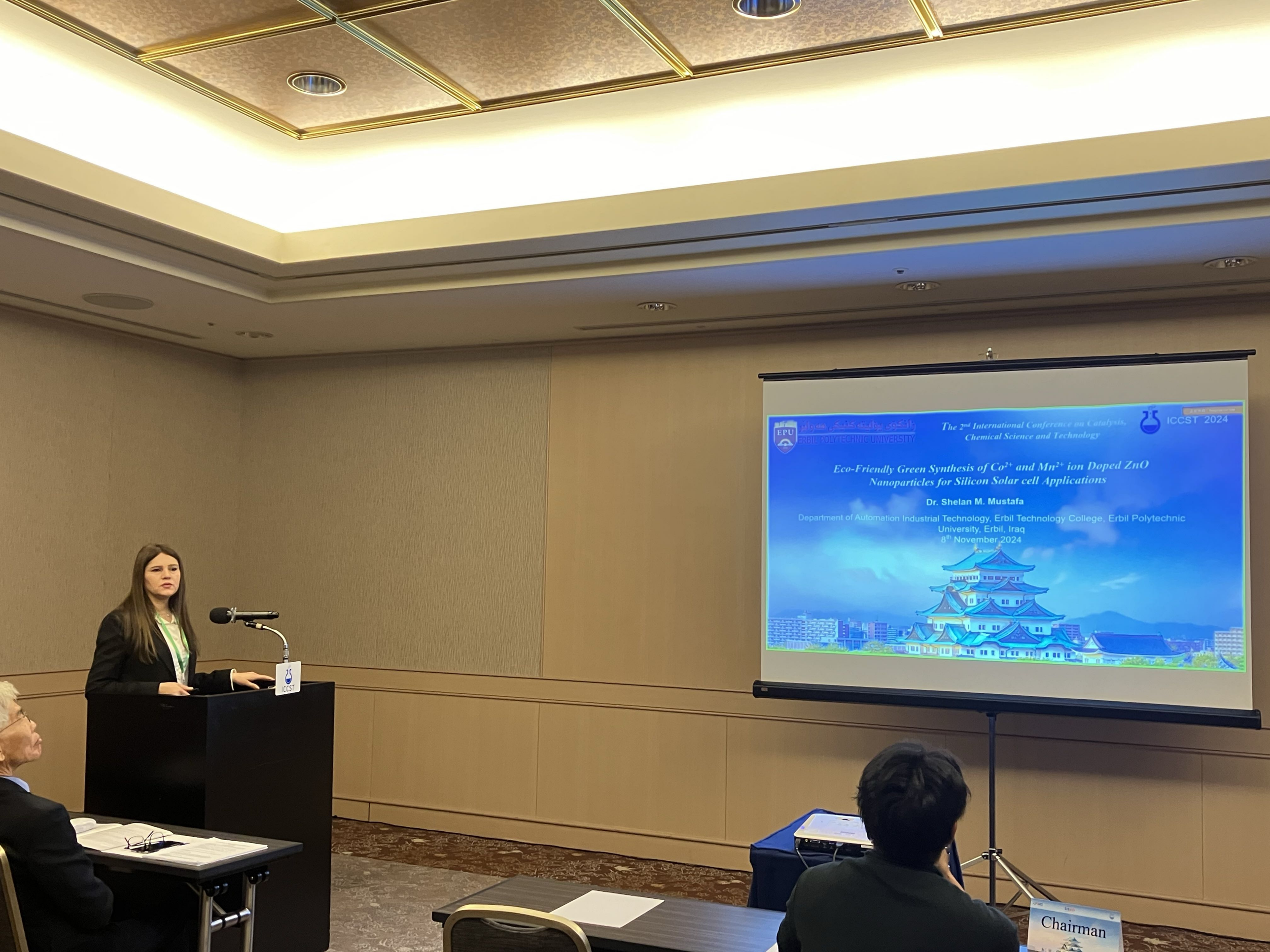
Keywords: ZnO NP, nanoparticles, Green Synthesis, Dandelion Leaf extract

Biography

Dr. Shelan M. Mustafa, hailing from Erbil, Iraq, is a renowned academic deeply versed in physics and nanotechnology. She earned her Bachelor of Science degree in General Physics and her Master of Science degree in Nanotechnology from Salahaddin University, Erbil, in 2001 and 2010, respectively. Continuing her academic journey, she obtained her Ph.D. from the Scientific Research Centre at Soran University.

In October 2011, Dr. Mustafa began her academic career at Erbil Technology College at Erbil Polytechnic University. She quickly advanced and was appointed Vice Head of the Road Department in 2012. Her leadership abilities and expertise were further recognized when she assumed the role of Head of the Electricity Department, a position she held from 2014 to 2020. During her tenure, she played a pivotal role in transforming the department into the Automation Industrial Technology Engineering department, which offers both diploma and Bachelor's degrees. On July 25, 2024, she was appointed Director of Scientific and Higher Education at the Erbil Polytechnic University Presidency, a position she continues to hold.

Dr. Mustafa's research interests are extensive and influential, encompassing pioneering fields such as nanotechnology, renewable energy, and solar cell technology. She has devoted considerable effort to studying green synthesis methods, nanomaterials, and semiconductor nanostructure devices. Her research also delves into the physical properties of materials at the nanoscale, with a particular focus on surface structure analysis and X-ray diffraction techniques. Dr. Mustafa's contributions in these areas have significantly enhanced the academic and practical understanding of nanotechnology and renewable energy solutions.


The 2nd International Conference on Catalysis, Chemical Science and Technology
ICCST 2024
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8th November 2024
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