

Non-focusing mode of plasma focus based alternative technology to synthesize ZnO films for structural and optical properties

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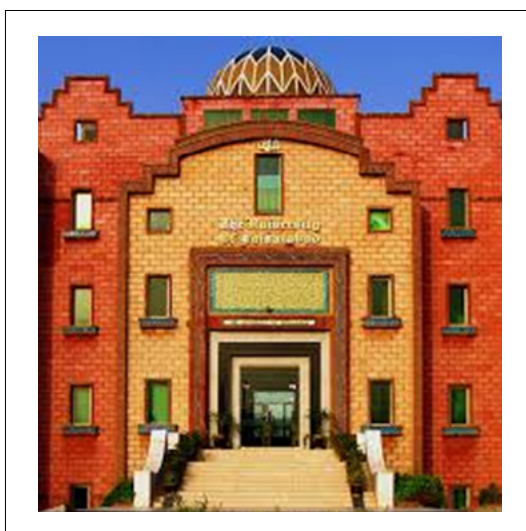
Abstract

Dense plasma focus (DPF) device is conventionally operated in two modes of operation (i) focus mode and (ii) non-focused. The emanated ions are highly energetic in focused mode than in non-focused mode of operation. In this work, we report the first ever application of non-focus mode of DPF device for the synthesis of ZnO TFs on Si substrates for different number of non-focused deposition shots (NFDS). XRD analysis of unannealed ZnO TFs confirms its growth along (0 0 2) orientation while the annealed ZnO TFs grows along (1 0 0), (0 0 2) and (1 0 0) orientations showing improved crystallinity. The residual stresses in unannealed ZnO TFs are more than in annealed ZnO TFs. The surface morphology of ZnO TFs is strongly associated with increasing number of NFDS as well as annealing temperature. Raman analysis exhibits the development of downshifted E2 (high) and upshifted A1 longitudinal optical (LO) modes centred at 430 cm⁻¹ and 580 cm⁻¹ thereby indicating the presence of tensile residual stress due to mismatch of thermal expansion coefficient of ZnO TF and Si substrate and due to the presence of oxygen vacancies and Zn interstitials, respectively. The XPS study confirms the presence of Zn, Zn-O, C-O, and Zn-OH bonds. The E_g and n of annealed ZnO TFs are found to be 3.30 eV and 1.88, respectively. The synthesis of high quality ZnO TFs by using MHD instability free non-focusing mode of DPF device will open a new alternative synthesis technique for novel materials.

Keywords: Non-focusing mode; Dense plasma focus; Non-focused deposition shots; Energy band gap; Oxygen vacancies

Biography

I have completed my PhD from GC University Lahore, Pakistan and postdoctoral studies from National Institute of Education, Nanyang Technological University Singapore. Now I am working as Associate Professor of Physics at Government College University Faisalabad, Pakistan. I have published more than 30 research articles in reputable journals. I have reviewed many research articles as reviewer requested by reputable journals.



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