

A study of Cu-doped ZnO thin film growth by plasma-assisted molecular beam epitaxy

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p-ZnO thin films were grown on the n-6H:SiC(0001) single crystal substrates by plasma-assisted molecular beam epitaxy with Cu as a dopant material. A p-n hetero-junction with p-Cu:ZnO/n-6H:SiC was successfully fabricated and demonstrated as a greenish-blue light emitting diode (LED). In the fabricated p-n hetero-junction LED current-voltage curve of the device showed good rectifying behavior and electroluminescence emissions also coincided with photoluminescence. The Cu oxidation state related to the electrical conversion from n-type to p-type is influenced by the Cu cell temperature (T_{Cu}) and the post-deposition annealing environment. The higher T_{Cu} and post-annealing in O-plasma were believed to be the favorable conditions for the Cu^{2+} and hence the p-type nature of the films.