ORIGIN OF THE n-type CONDUCTIVITY IN ELECTROCHEMICALLY PREPARED Cu_2O FILMS

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Electrochemically prepared Cu_2O is an n-type semiconducting material compared to the well established result of p-type conductivity in thermally grown Cu_2O. However, the origin for this behaviour is still not very well understood. We have undertaken a study to investigate this behaviour by studying the variations in the semiconducting properties of n-Cu_2O films under the heat treatments in different Oxygen ambients. Our results reveal that the concentration of the Oxygen in the atmosphere plays an important role in determining the convertion of the n-type to the p-type. We have observed that the n-type behaviour is saturated if the Oxygen concentration is sufficiently low. Our observations clearly demonstrate the existence of Oxygen vacancies in the electrochemically prepared Cu_2O which results in then n-type conductivity. It has been predicted previously that compensated n-type conductivity is possible in Cu_2O if the Oxygen vacancies are larger than the Copper ion vacancies. Our investigation concludes that the Oxygen vacancies are created in the crystal lattice of Cu_2O when the material is prepared electrochemically.

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References

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