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Materials properties of cupric and cuprous oxide films

PARK Young Ran, KIM Kwang Joo, AHN Geun Young¹, KIM Chul Sung¹, PARK Jae Yun²

(Konkuk University, Physics. ¹Kookmin University, Physics.
²Incheon University, Materials Science and Engineering.)

Cupric and cuprous oxide (CuO and Cu₂O) films were prepared on Al₂O₃(0001) substrates by sol-gel method using single precursor solution made by dissolving (C₂H₅O₂)₂Cu·H₂O powder into a mixed solution of 2-methoxyethanol and monoethanolamine. CuO films were obtained by annealing in air in the 300 - 800 °C range while Cu₂O films could only be obtained by annealing in vacuum. Especially, Cu₂O coexist with copper quantum dots in the film. The optical, magnetic, and electrical properties of the films were measured by spectroscopic ellipsometry, vibrating-sample magnetometry, Mössbauer spectroscopy, and Hall effect measurements. Undoped CuO films exhibit p-type conductivity while the Fe doped ones insulating. The CuO:Fe films show no second phase; nonetheless they are found to exhibit ferromagnetism at room temperature.