

**Synthesis of the non-toxic  $\text{Cu}_{2-x}\text{S}$  and  $\text{Cu}_{2-x}\text{Se}$  nanocrystals : A new approach to  $p$ -type transistor**

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We demonstrated a hot-injection method to synthesize high quality copper chalcogenide nanocrystals (NCs) and investigated their optical and electrical properties. Unlike conventional NCs containing heavy metal, copper chalcogenide NCs exhibit not only the non-toxicity but also interesting optical characteristics, such that they show optical absorbance in the near infrared (NIR) region based on localized surface plasmon resonance (LSPR) effects. In particular, the LSPR effects are attained for copper chalcogenides that have copper deficiencies ( $\text{Cu}_{2-x}\text{S}$  or  $\text{Cu}_{2-x}\text{Se}$  NCs) which generate plentiful of free holes in the NCs. Such phenomena, in other words, imply that these materials, in principle, should exhibit  $p$ -type transistor properties, which is somewhat rare for inorganic NC systems. Here, we exploit their  $p$ -type conductivity for transistor applications.