Journal of Zhejiang University-SCIENCE A

Cite this as: Xin Wang, Zhi-zhen Ye, Yi-zheng Jin, 2017. Syntheses and characterizations of alloyed $Co_xNi_{1-x}O$ nanocrystals. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 18(4):306-312. http://dx.doi.org/10.1631/jzus.A1600399

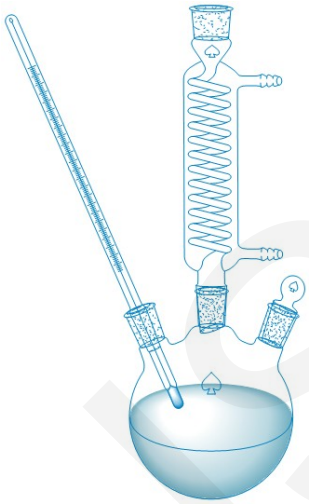
Syntheses and characterizations of alloyed $Co_xNi_{1-x}O$ nanocrystals

Key words:

Alloying, Nickel oxide, Cobalt oxide, Colloidal nanocrystals



Method



$Ni(St)_2+Co(St)_2+LiSt+ODA+ODE$

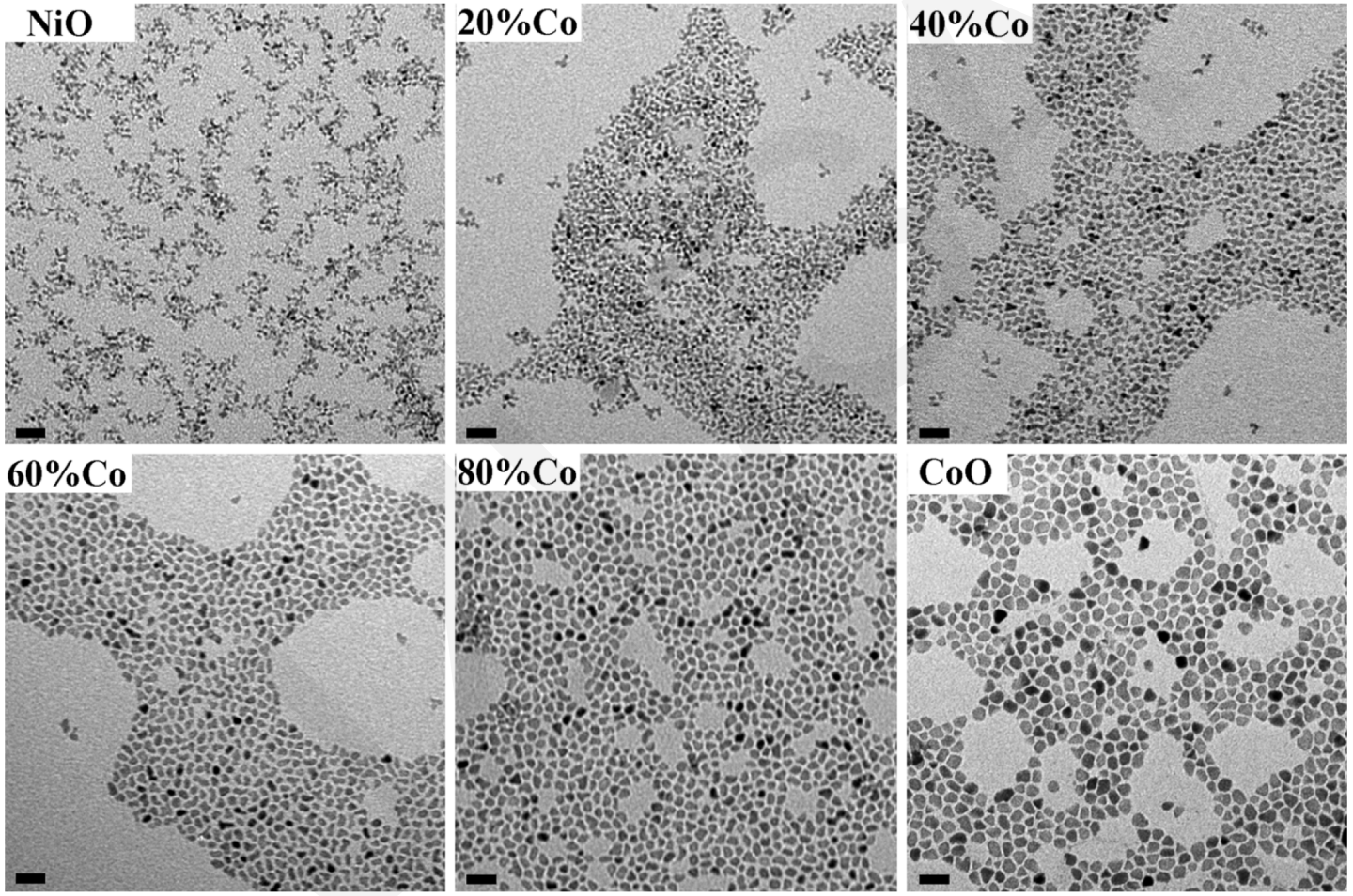
$$M\,(R_1\text{-}COO)_2 + R_2\text{-}OH \xrightarrow[LiSt]{Ar,\ 270℃} R_1\text{-}COO\text{-}R_2 + MO + H_2O$$

$Ni(St)_2 = Ni(C_{17}H_{35}COO)_2$ $\quad$ $LiSt = C_{17}H_{35}COOLi$

$Co(St)_2 = Co(C_{17}H_{35}COO)_2$ $\quad$ $ODA = C_{18}H_{37}OH$

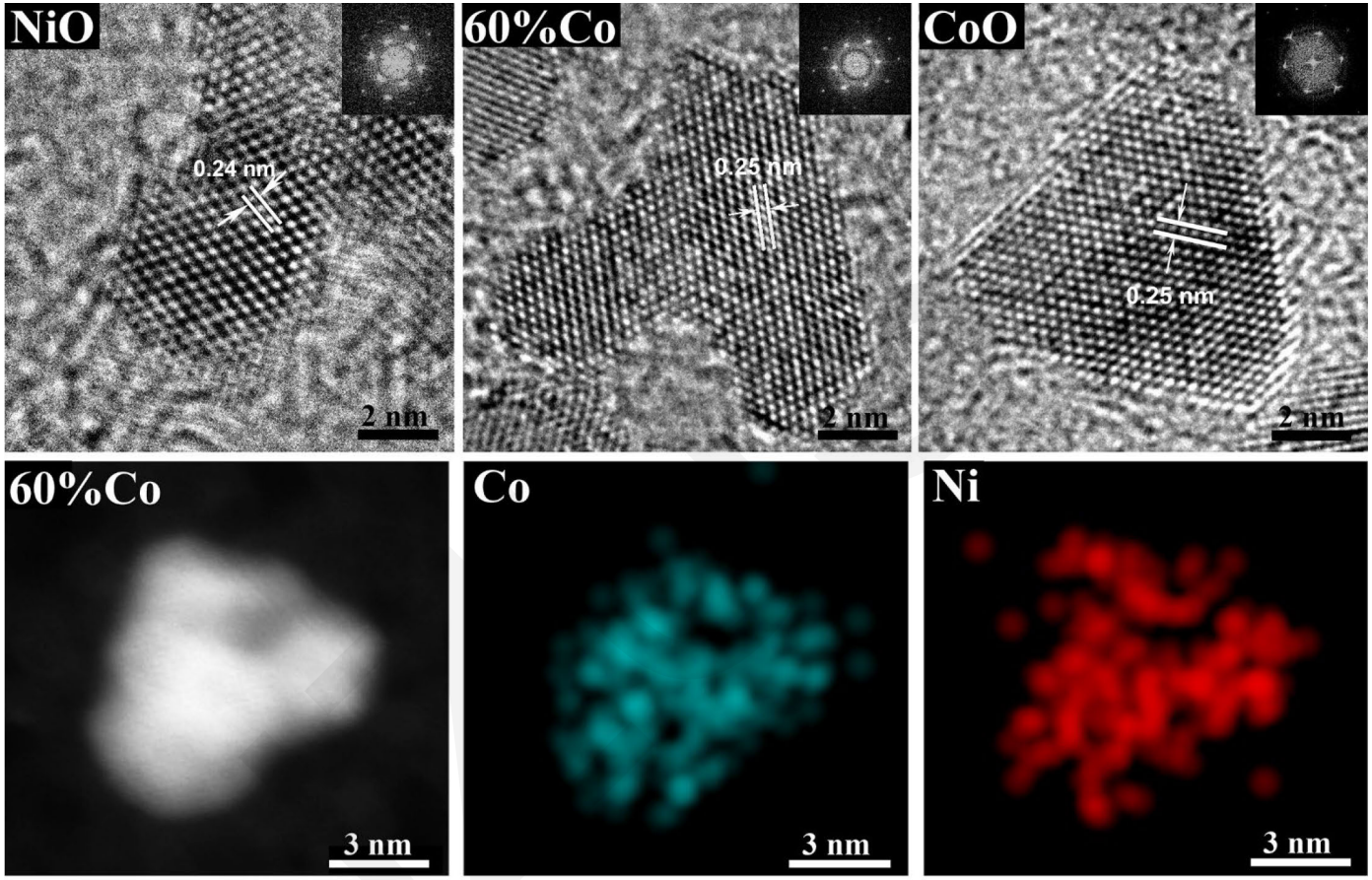
Shape control

scale bar=20 nm



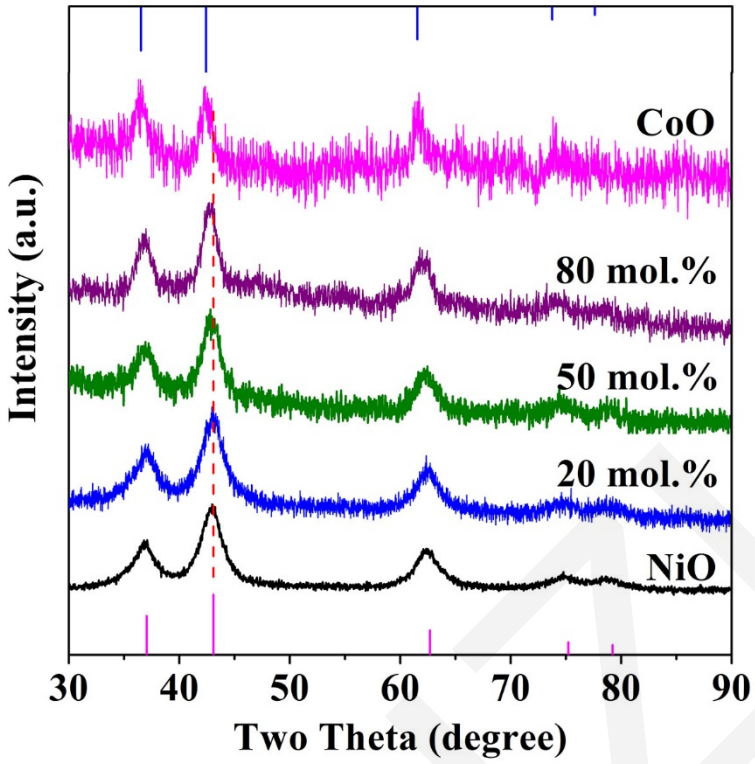
nanoclusters→V-shaped nanocrystals→isolated nanoparticles

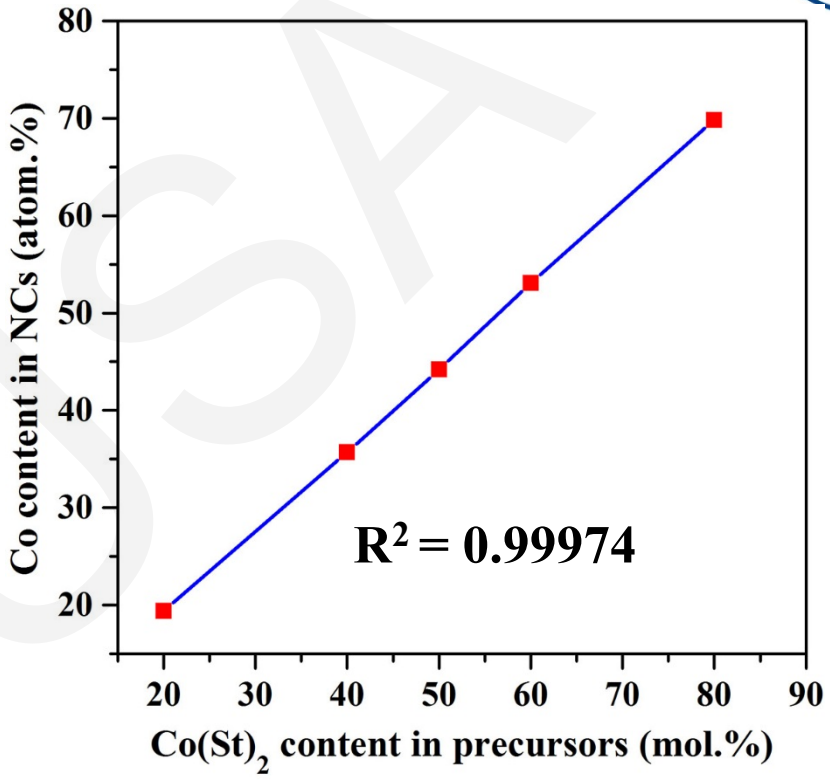
Crystal structures and elemental distributions



- NiO, $Co_xNi_{1-x}O$, and CoO nanocrystals show cubic rock salt structure
- Co and Ni elements are homogeneously distributed in the alloyed nanocrystals

Evolutions of crystal structures and compositions





- The crystal structures of all oxide nanocrystals match the face-centered cubic structure
- The content of cobalt in the alloyed nanocrystals has a linear correlation with the molar ratio of $Co(St)_2$ in the reagents

Chemical valence

- **Ni**

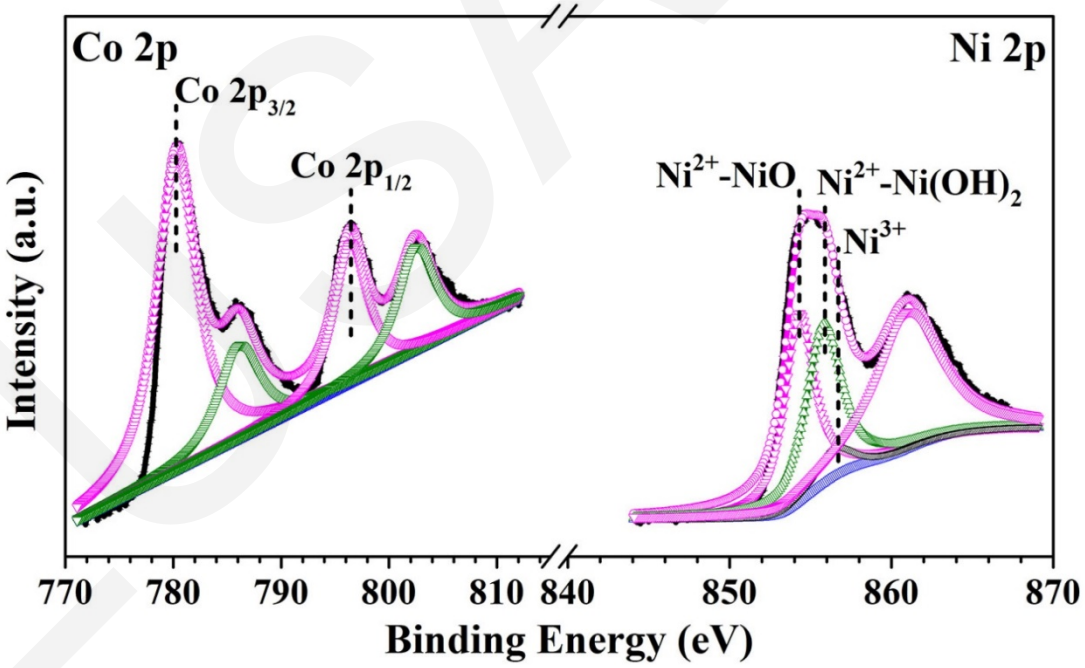
  The existence of $Ni(OH)_2$ and NiO

  Trace amount of Ni^{3+} is detected .

- **Co**

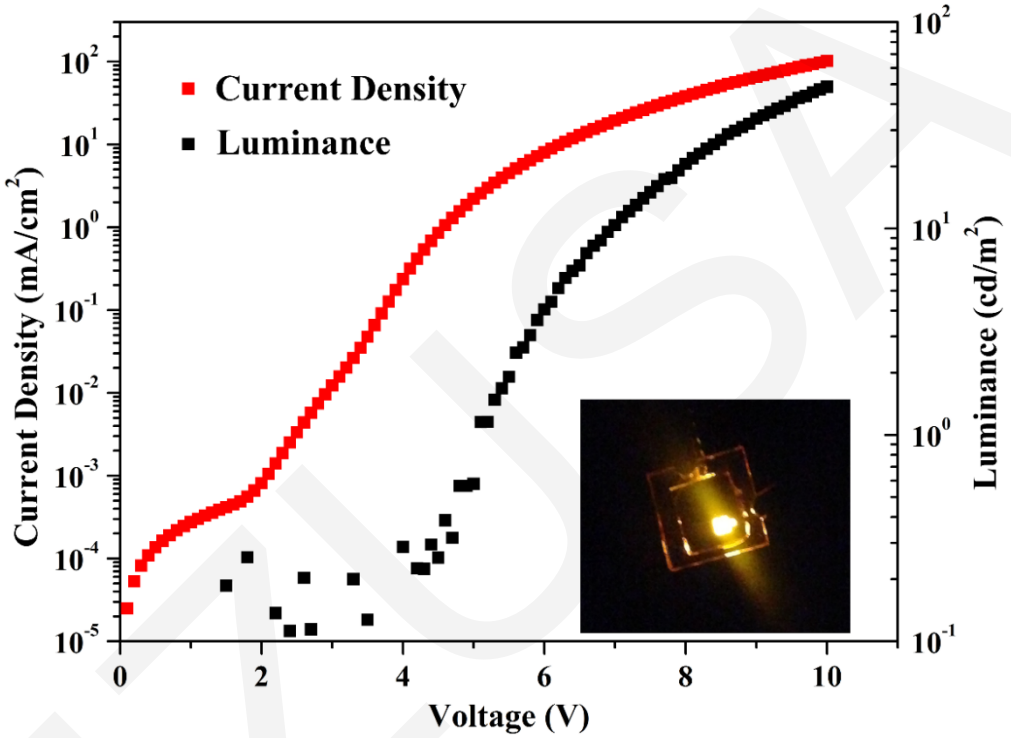
  $Co2p_{1/2}$ satellite peak:

  The intensity ratio of Co $2p_{1/2}$ satellite peak to main peak was ~0.9 in CoO and ~0.3 in Co_3O_4, respectively.



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PLEDs Based on MEH-PPV Emissive Layers



- **A model system of ITO/$Co_xNi_{1-x}O$/MEH-PPV/Ca/Al is used to confirm that the $Co_xNi_{1-x}O$ nanocrystals can act as an effective hole-transporting material.**

Conclusions

- We demonstrated the syntheses of quality alloyed $Co_xNi_{1-x}O$ (x=0~1) nanocrystals by the protecting-ligand assisted approach.
- The composition-dependent morphologies and crystal structures of the alloyed $Co_xNi_{1-x}O$ nanocrystals can transform from NiO-dominated to CoO-dominated characteristics.
- EDS mapping results indicate homogeneous distributions of Ni and Co atoms within the nanocrystals.
- Our study provides a good example for the syntheses of alloyed oxide nanocrystals with continuously tunable compositions.

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