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# $NiCo_2S_4$ Nanotrees Directly Grown on the Nickel NP-Doped Reduced Graphene Oxides for Efficient Supercapacitors

**Wooree Jang [1], Won San Choi [2] and Youn-Sik Lee [3,*] and Hye Young Koo [1,*]**

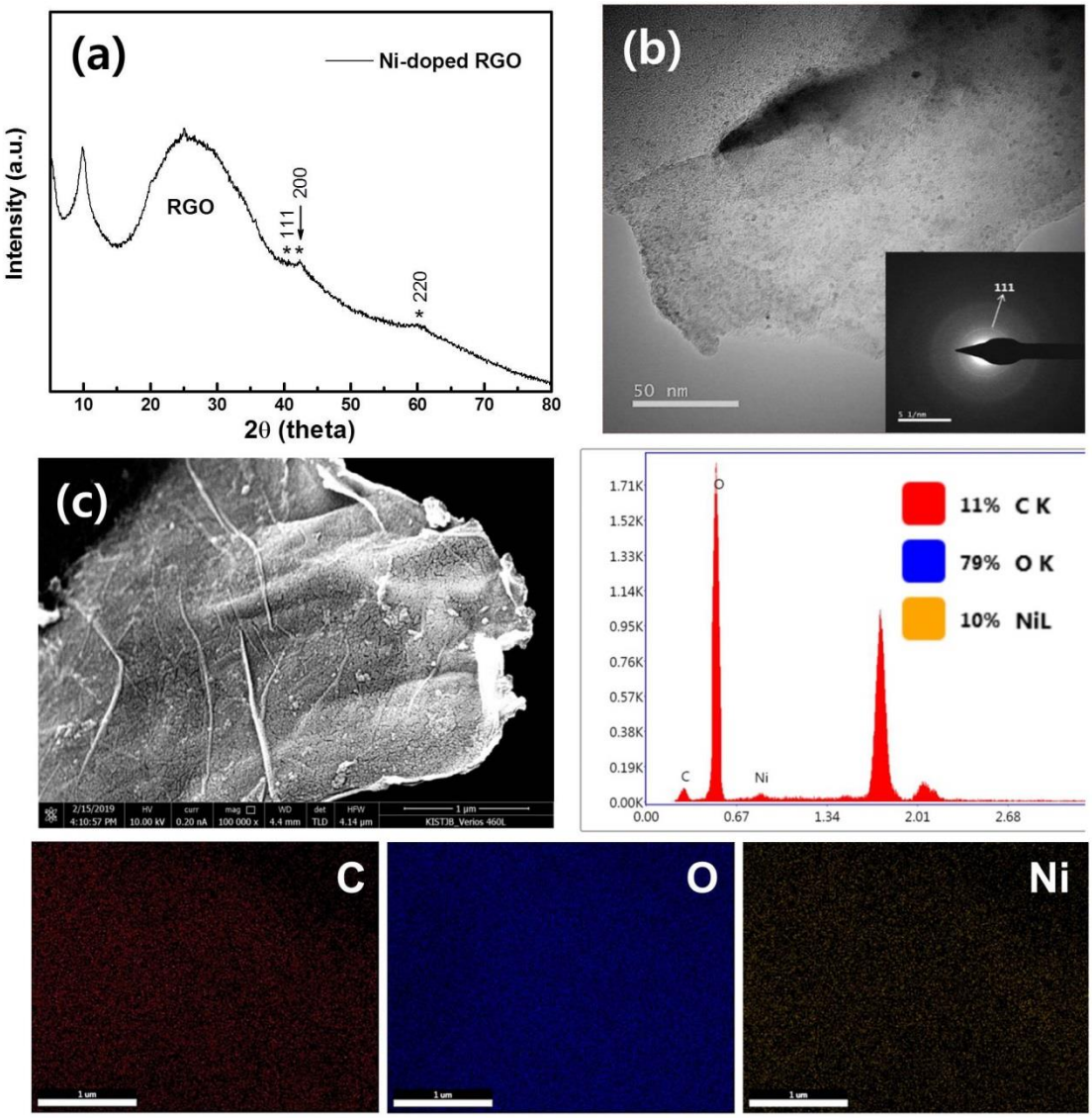


**Figure S1.** Characterizations of the Ni-rGOs. (**a**) XRD spectrum; (**b**) TEM image; (**c**) SEM image and corresponding EDS mapping of element C, O, and Ni results. XRD spectrum indicates the (200) crystal planes of cubic Ni lattice, and nominal (111) and (220) crystal planes of NiO lattices. The TEM and SEM images revealed the presence of Ni particles with uniform sized and well dispersed on the rGOs. The EDS mapping also shows uniform distributions of Ni on the surface of the rGOs.

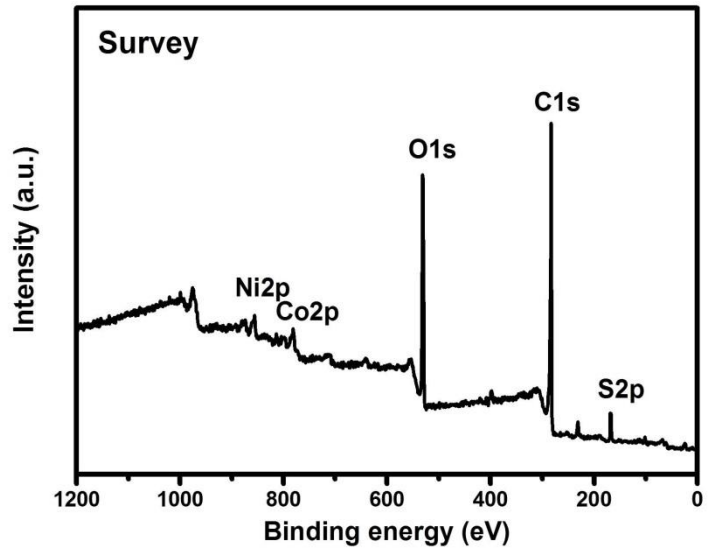


**Figure S2.** XPS survey scan of the $NiCo_2S_4$/Ni-rGO nanocomposites.

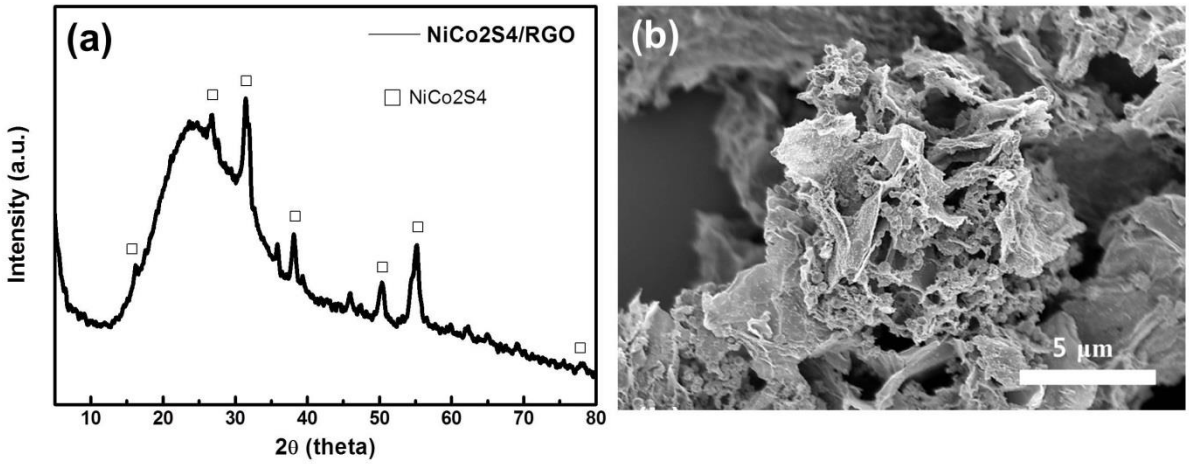


**Figure S3.** Characterizations of the $NiCo_2S_4$/rGO nanocomposites without doping of Ni ions on the surface of the rGOs. (**a**) XRD spectrum; (**b**) SEM image.

| Composite material | Specific capacitance (F $g^{-1}$) | Current density (A $g^{-1}$) | Cycle life | Reference |
|---|---|---|---|---|
| NiCo2S4@rGO@ CNT composite | 1242 | 2 | 54% after 2000 cycles | [1] |
| NiCo2S4 crystal nanostructure | 835 | 1 | 92.7% after 5,000 cycles | [2] |
| NiCo2S4-rGO porous composite | 1107 | 1 | 95% after 8,000 cycles | [3] |
| NiCo2S4 caterpillar-like nanostructures | 1777 | 1 | 83% after 3,000 cycles | [4] |
| Co3O4@CoS on carbon | 764 | 1 | 78.1% after 5,000 cycles | [5] |
| NiCO2S4 nanosheets on graphene | 1220 | 1 | 91% after 2,000 cycles | [6] |
| NiCo2S4/rGO nanotrees | 860 | 1 | 91.6% after 10,000 cycles | This work |

**Figure S4.** Performance comparison of the $NiCo_2S_4$/Ni-rGO nanocomposite electrode materials with previous works based on similar materials.

## References


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