Surfactant free gram scale synthesis of mesoporous $Ni(OH)_2$-r-GO nanocomposite for high rate pseudocapacitor application

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Electronic Supplementary Information (ESI)

ESI-I: SEM image, elemental map, and energy dispersive x-ray analysis (EDAX) data for (a-c) $Ni(OH)_2$-r-GO and (d-f) $Ni(OH)_2$.

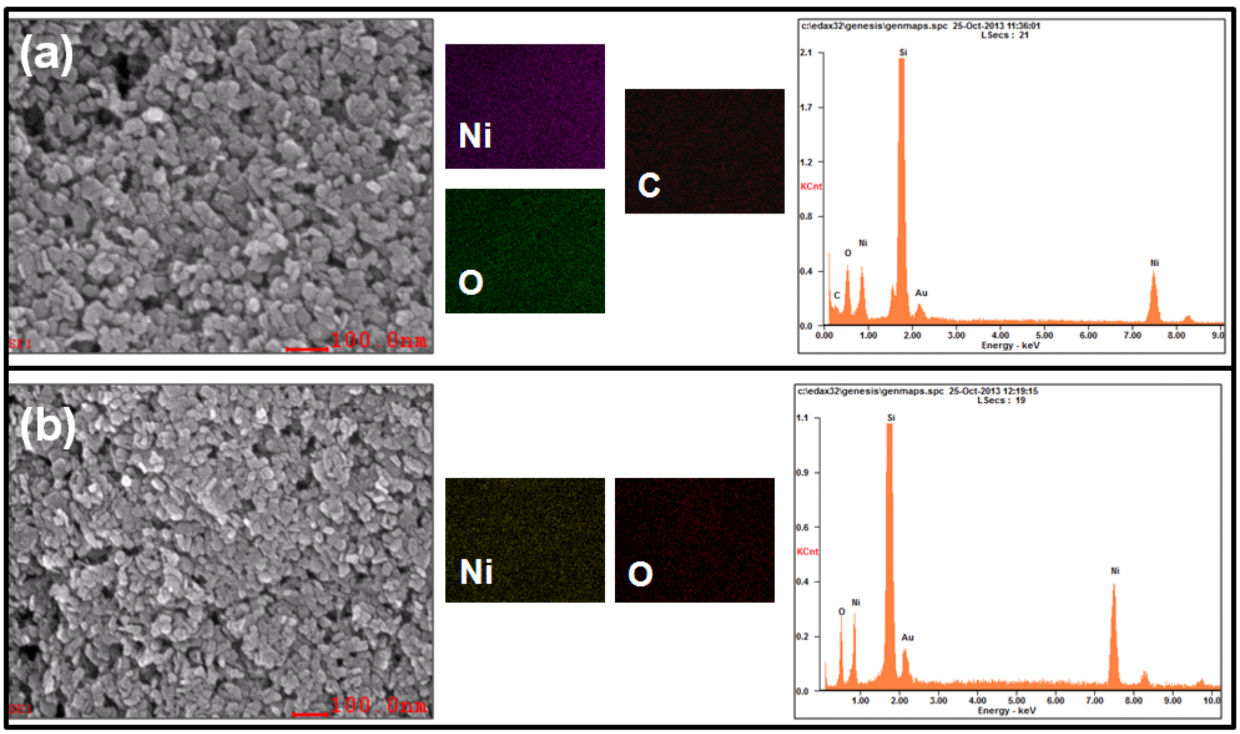

Figure above shows the Scanning Electron Microscopy (SEM) and energy dispersive x-ray analysis (EDAX) analysis for $Ni(OH)_2$-r-GO (a) and $Ni(OH)_2$ (b). The presence of different faceted structures for $Ni(OH)_2$ in both the samples can be easily observed (please see Figure a and b). The morphology is mainly dominated by hexagonal plates. In the case of $Ni(OH)_2$-r-GO as well the basic morphology is similar. In order to confirm the presence of graphene we drop casted the composite solution on conducting silicon substrate to perform the elemental mapping analysis. The map shown in the Figure b shows the overlay of nickel (Ni), oxygen (O) and carbon (C). The inset of Figure b shows the elemental maps of individual element present in the sample, confirming their uniform distribution in the $Ni(OH)_2$-r-GO composite. Energy dispersive analysis of x-rays (EDAX) spectrum for $Ni(OH)_2$-r-GO is depicted in Figure c. Figure (d-f) show the FE-SEM image, elemental mapping, and EDAX spectrum for the bare $Ni(OH)_2$ sample for comparison. No carbon contribution is seen as expected.

ESI-II: Table 1. Comparison of results with recent reports

Electrode Structure	**Synthesis Method**	**Electrolyte**	**Specific capacitance at low current density/scan rate**	**Specific capacitance at high current density/ scan rate**
$Ni(OH)_2$- r-GO (Present work)	**Hydrothermal**	**2M KOH**	**1795 Fg^{-1}@ $1Ag^{-1}$**	**1538 Fg^{-1}@ 40 Ag^{-1}**
$Ni(OH)_2$ /Carbon Paper) (Present work)	Hydrothermal	2M KOH	1707 Fg^{-1}@ $1Ag^{-1}$	936 Fg^{-1}@ 40 Ag^{-1}
$Ni(OH)_2$/UGF [45]	CVD	6M KOH	1560 Fg^{-1} @ 0.5 Ag^{-1}	1092 Fg^{-1} @ 10 Ag^{-1}
$Ni(OH)_2$/r-GO/NF [46]	Reflux reaction	1M KOH	1828 Fg^{-1} @ 1 Ag^{-1}	780 Fg^{-1} @ 10 Ag^{-1}
$Ni(OH)_2$/Graphene/NF [32]	Co-precipitation	6M KOH	2194 Fg^{-1} @ 2 mVs^{-1}	895 Fg^{-1} @ 20 mVs^{-1}
$Ni(OH)_2$/Graphene/NF [47]	Hydrothermal	6M KOH	1985.1Fg^{-1}@5 Acm^{-2}	912.6Fg^{-1}@ 40 $mAcm^{-2}$
$Ni(OH)_2$/Graphite/NF [48]	Reflux reaction	6M KOH	1956 Fg^{-1} @ $1Ag^{-1}$	1519.9 Fg^{-1} @ 40 Ag^{-1}
$Ni(OH)_2$/Graphene/NF [49]	Precipitation	6M KOH	2134 Fg-1 @ 2 mVs^{-1}	822 2 Fg^{-1} @ 70 mVs^{-1}
$Ni(OH)_2$/Graphite [50]	Electrodeposition	5.3M KOH	1850 Fg^{-1} @ 3.2 Ag^{-1}	550 Fg^{-1} @ 11.9 Ag^{-1}
RGO/$Ni(OH)_2$/NF [51]	Hydrothermal	1M KOH	1667 Fg^{-1} @ 3.3 Ag^{-1}	444.75 Fg^{-1} @ 33 Ag^{-1}
RGO/CNT/$Ni(OH)_2$/ NF [52]	Hydrothermal	2M KOH	1320 Fg^{-1} @ 6 Ag^{-1}	943 Fg^{-1} @ 25 Ag^{-1}
$Ni(OH)_2$/Graphite [2]	Electrodeposition	1M KOH	1868 Fg^{-1} @ 20 Ag^{-1}	1430 Fg^{-1} @ 40 Ag^{-1}