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Ni(OH)2 decorated graphene for application in asymmetric hybrid supercapacitor

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Asymmetric hybrid supercapacitors (AHSCs) exploit the advantages of both supercapacitors and batteries by storing charges through both capacitive processes and redox reactions. The capacitive electrical double layer is effectively harnessed using graphene electrodes due to its exceptional specific surface area. Meanwhile, redox reactions are introduced by means of transition metal oxide/hydroxide materials, such as Ni(OH)2 which possess a theoretical specific capacity exceeding 1400 C/g in KOH-based aqueous electrolyte [1].The physico-electrochemical properties and the application of both graphene and Ni(OH)2-decorated graphene electrodes in an AHSC are characterized. Reduced graphene, produced via thermal exfoliation of graphite oxide (TEGO), with a specific surface area of 600 m2/g [2], is a good candidate as a supercapacitor electrode, achieving a specific charge of 110 C/g at 10 mV/s. Moreover, owning a great defect amount, TEGO is able of anchoring Ni nanoparticles (NPs). During the early voltammetry cycles in KOH 3.5 M aqueous electrolyte, metal Ni-NPs are converted in Ni(OH)2, enabling the positive electrode to reach a high reversible specific charge of 800 C/g at 10 mV/s. The effective oxidation of Ni-NPs to nickel hydroxide is proved by both powder-XRD and operando Raman spectroscopy. Coupling TEGO with Ni-NPs decorated TEGO, an extended working voltage window of 1.5V has been reached [3].

Primary author: Dr MORENGHI, Alberto (Nanocarbon Laboratory, Università degli Studi di Parma, INSTM, GISEL)

Co-authors: Prof. PONTIROLI, Daniele (Nanocarbon Laboratory, Università degli Studi di Parma, INSTM, GISEL); Dr MAGNANI, Giacomo (Nanocarbon Laboratory, Università degli Studi di Parma, INSTM, GISEL); Dr BERTONI, Giovanni (CNR - Istituto di Nanoscienze, Modena, Italy); Dr AVERSA, Lucrezia (IMEM-CNR, Povo (TN), Italy); Dr SIDOLI, Michele (Nanocarbon Laboratory, Università degli Studi di Parma, INSTM, GISEL); Dr VERUCCHI, Roberto (IMEM-CNR, Povo (TN), Italy); Dr SCARAVONATI, Silvio (Nanocarbon Laboratory, Università degli Studi di Parma, INSTM, GISEL)

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