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Free-standing Conductive Fe_3O_4/Graphene/CNT Film As Anodes for Lithium-Ion Batteries YUE CAI, YINGWEN CHENG, SONGTAO LU, HONGBO ZHANG, Duke University, Durham, NC, 27708, C.V. VARANASI, Army Research Office, Research Triangel Park, NC 27709, JIE LIU, Duke University, Durham, NC, 27708, ARMY RESEARCH OFFICE, RESEARCH TRIANGEL PARK, NC 27709 COLLABORATION — Fe3O4 is known as a material for lithium-ion battery anodes due to its high theoretical specific capacity. But it has limitations, such as low conductivity and poor cyclic performance etc. To address these problems, free-standing Fe3O4/Graphene/Carbon nanotube(CNT) films were prepared via hydrothermal reaction methods. The synergistic effect of graphene and CNTs provide a flexible matrix for Fe3O4. A series of experiments were performed to determine important processing factors such as carbon ratio and annealing treatments, which influenced the overall LIB performances. Currently the best film had a sheet resistance of 23 ohm/sq and a BET surface area of 132 m2/g. In addition, the lightweight films were directly tested as lithium-ion battery anodes without using a current collector or a binder, eliminating unnecessary weight in the overall devices. This metal oxide loaded carbon film had both excellent conductivity and strong mechanical strengths. The discharge capacity was found to reach 880 mAh/g at 200 mA/g current density and 580 mA/g at 400 mA/g. The rate capability tests (from 200 mA/g up to 1200 mA/g) also indicated that the lab prepared Fe3O4 loaded films have much better performance as compared to the samples made by using commercial Fe3O4.

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