



U.S. Department of Energy

Categorical Exclusion Determination Form

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Project Title: 25A2340 - Silicon Coated Nanofiber Paper as a Lithium-Ion Anode

Location: *- Multiple States - Ohio, Missouri, California, South Carolina

Proposed Action or Project Description:

American Recovery and Reinvestment Act:

Silicon coated carbon nanofiber paper is a transformative advance for lithium ion batteries. This unique anode material shows stable cycling, low irreversible capacity, and energy storage >1000 mAh/g (based on its full weight). Its effective energy storage can be far higher via dual use as an active material and a current collector (saving weight/cost/volume). This material is made using bulk-available nanofibers combined with an advanced inexpensive Si deposition method that keeps the materials cost under \$185/lb, clearly practical. It is made in two steps. 1) A porous, flexible, conductive pure carbon nanofiber paper is first prepared. A sophisticated nonwoven papermaking process has already been developed to make the uncoated paper, and professional pilot-scale equipment to produce it on a continuous basis has been built. 2) Then the paper is coated throughout with silicon, covering the individual nanofibers within the paper with a smooth, adherent, nanoscale amorphous Si layer. At this time, the coating step is being carried out on small stationary sheets of nanofiber paper. The first R&D Objective is a proof-of-principle demo that the Si-coating can be done in a continuous fashion onto a moving substrate of nanofiber paper; small-scale moving-belt coating equipment will be built/demonstrated. The second Objective is to construct/test full cells and create additional performance proof for this technology. The third Objective is to develop battery-compatible metallic joining technology for the coated paper, so that it may ultimately be used as both active material/current

Categorical Exclusion(s) Applied:

X - B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects

*-For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, see Subpart D of 10 CFR10 21 [Click Here](#)

This action would not: threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive Orders; require siting, construction, or major expansion of waste storage, disposal, recovery, or treatment facilities, but may include such categorically excluded facilities; disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; or adversely affect environmentally sensitive resources (including but not limited to those listed in paragraph B.(4)) of Appendix B to Subpart D of 10 CFR 1021). Furthermore, there are no extraordinary circumstances related to this action that may affect the significance of the environmental effects of the action; this action is not "connected" to other actions with potentially significant impacts, is not related to other proposed actions with cumulatively significant impacts, and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211.

Based on my review of information conveyed to me and in my possession (or attached) concerning the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: /s/ William J. Bierbower

Digitally signed by William J. Bierbower
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Date Determined: 12/18/2009

Comments:

Webmaster:



25A2340 - Proposed Action or Project Description (Continued)

to develop battery-compatible metallic joining technology for the coated paper, so that it may ultimately be used as both active material/current collector and achieve its full promise. The fourth Objective is expanded development of the existing pilot-scale papermaking equipment as a bridge to a future commercial system. The sum of these Objectives is the project goal, which is to demonstrate cost/manufacturing/performance features that will define this as a commercially compelling next-generation technology, attracting investment/support for its next stage of development. This material is unique in that it simultaneously meets the real-world criteria of breakthrough energy storage, low irreversible capacity, low cost and viable manufacturability. It is transformational because of its impact on energy storage technology, American industry, petroleum use, and the environment. This is an enabling technology for wind/solar generators, a key to making electric vehicles viable, a huge green industrial opportunity and a job creation engine. It positively impacts every item in the Administration's ARPA agenda. The underlying carbon nanofiber paper itself is a platform technology. Different varieties have applications in batteries, electrochemical capacitors, composites, high-frequency EMI shielding, and heat conduction. Still, the Silicon-coated version for Li-ion batteries is the so-called 'killer application' for it. This anode more than triples the energy storage of current anode materials, and it can more than double the energy storage of the overall battery. The battery improvement it provides will become amplified as cathode technology and electrolytes improve. Its successful commercialization will assert American science leadership, create a significant reduction in greenhouse gases, and transform many manufacturing industries in America.