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JCESR: A New Paradigm for Battery Research

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The Joint Center for Energy Storage Research (JCESR) develops transformational concepts and technologies for portable electricity storage for transportation and stationary electric storage for the electricity grid. JCESR looks beyond lithium ion battery technology to new energy storage materials and phenomena to achieve transformational societal outcomes: energy storage with five times the performance at one-fifth the cost of today's commercial batteries. JCESR will leave three legacies: a library of fundamental scientific knowledge of materials and phenomena for next-generation batteries, demonstration of transformational research prototypes for transportation and the grid, and a new paradigm for battery research that integrates discovery science, battery design, research prototyping and manufacturing collaboration in a single highly interactive organization.

JCESR pursues fundamental understanding and control at the atomic and molecular level of three beyond lithium ion electricity storage concepts: multivalent intercalation, chemical transformation, and non-aqueous redox flow. JCESR pursues these storage concepts with distinguishing tools, including computational genomic approaches to crystalline electrodes and liquid electrolytes, a state of the art electrochemical discovery laboratory for systematic synthesis and characterization of battery materials, techno-economic modeling of the performance and cost of proposed battery systems, and crosscutting management of prototype design, construction and testing.

An introduction to JCESR's vision and organization will be followed by an outline of three grand science and technology challenges for next generation batteries: metal anodes, solvation/desolvation phenomena, and solid electrolyte interphases. An update on progress in JCESR's first 18 months of operation will be given, featuring highlights from discovery science, battery design, research prototyping and manufacturing collaboration.

Keywords: Beyond lithium ion, electrical energy storage, electric vehicles, electricity grid



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储能研究联合中心（JCESR）为便携式电力储存运输和固定蓄电供电网发展转型概念和技术。JCESR 超越锂离子电池技术，探索新型储能材料和现象来实现转型的社会成果：用今天的商用电池成本的五分之一来达到五倍的储能性能。JCESR 将带来三大财富：为下一代电池预备有关材料与现象的基本科学知识文库，为交通和电网显示转型研究原型，以及整合科学发现、电池设计、研究原型、以及制造协作，将其并在一个高度互动机制内的电池研究新范式。

JCESR 追求对三个超越锂离子电存储概念的基本了解和在原子 / 分子水平的控制：多价夹层，化学转化和非水氧化还原液流。JCESR 通过特别工具来实现对这些存储概念的追求，包括使用计算基因组学方法来处理晶体电极和液体电解质，为系统合成与表征电池材料的最新电化学发现实验室，为想象电池系统预测性能与成本的技术经济模型，将原型设计、建造和测试合一的交叉管理。

介绍 JCESR 的愿景和组织之后，将概要提出下一代电池的三个科技大挑战：金属阳极，溶剂化 / 脱溶现象，和固体电解质界面。对 JCESR 开始 18 个月在科学发现、电池设计、研究和原型制造协作方面的运作最新进展情况将给予特色重点介绍。

关键词：超越锂离子；电能存储；电动汽车；电力网