Brainstorming/writing a successful (DOE) proposal







Steps in the process:

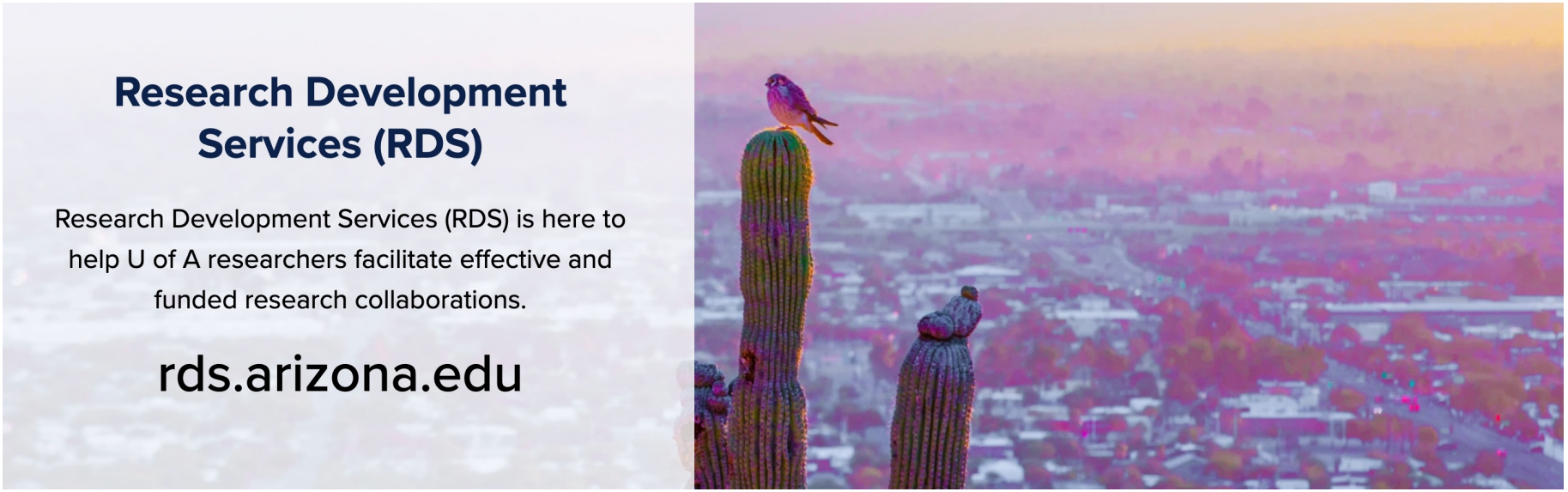
- Build core-competency
- Networking! even as a grad student, but especially as a post-doc and young faculty
- Build partnerships and collaborations with DOE National Labs and User Facilities
- Basic Research Needs (BRN) reports and strategic plans
- Review proposals and papers when asked and look to see what has been funded recently in those programs – are their “knowledge gaps?”
- Discussions (where possible) with program directors (white papers?)
- Don’t be afraid of “use-inspired” research, but BES doesn’t build devices (platforms ☺)

- Writing – first page(s) are critical!!

SPECS

Get started early and make use of your (local) resources

For example:



https://research.arizona.edu/development

SPECS

Make use of your (local) resources

For example:

2024-2025 Academic Year

Click on the links or navigate using the sidebar to learn more.

- **NIH On-Demand Webinars**. Learn about grant writing for the NIH at your own pace in 6 sessions of 18 short videos (through March 2025).
- **International Coordination Group**. Discover how you can participate in collaborative international research through this seminar series for faculty and staff (through April 2025).
- **RDS Spotlight Series**. Learn how our Research Development team can help you access, maintain, and grow research funding (through April 2025).
- **Federal Fireside Chats**. Tune in to what's happening in D.C. with special presentations by government relations firm Lewis-Burke & Associates (through April 2025).
- **Webinar Series with Academic Research Funding Strategies**. Attend one or all of these workshops: 1) For New Faculty: Funding Your Research, 2) Pursuing Funding For The Social Sciences, 3) How to Write Successful Grants for Instrumentation, 4) Pursuing Funding from the Department of Energy.
- **NSF CAREER Grant Preparation Program**. Become NSF-Career-Grant savvy through this cohort-based writing group (through July 2025).
- **FREE DoD Funding Course** with **Wise Investigator**. Includes a video course on why you consider DoD funding, the approach, the organizations, programs, and connecting with those at DoD.



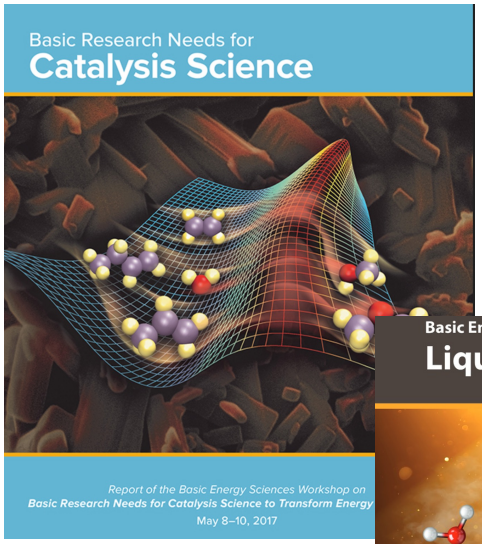
Make use of your (local) resources

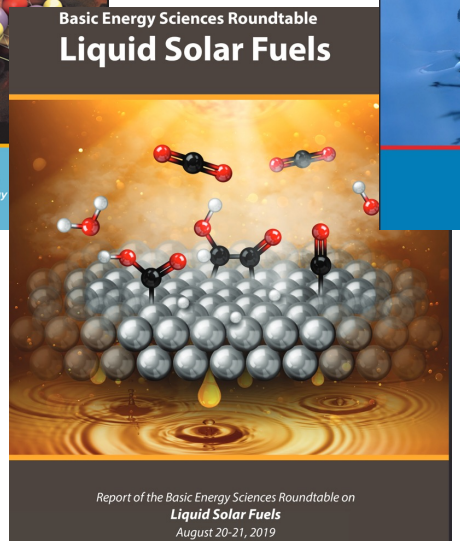
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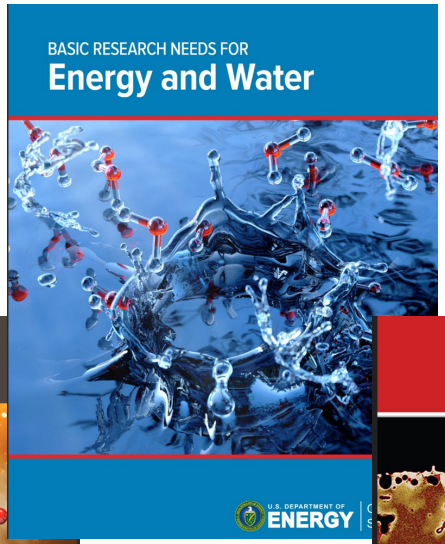


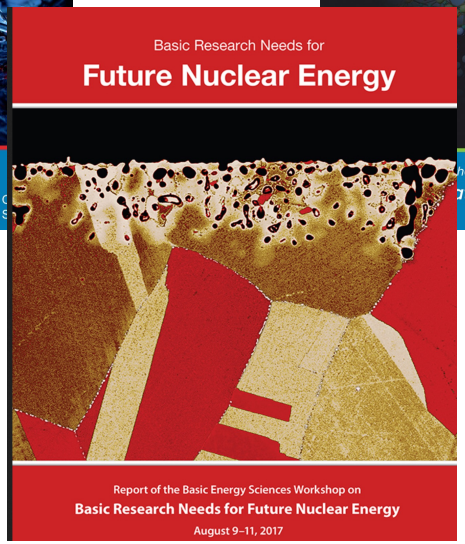
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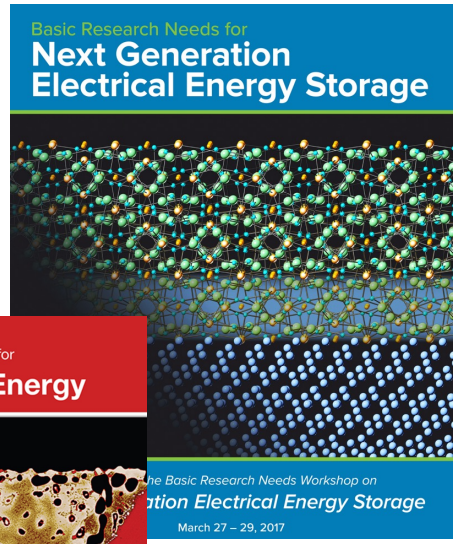
Basic Research Needs (BRN) workshop reports are fantastic resources





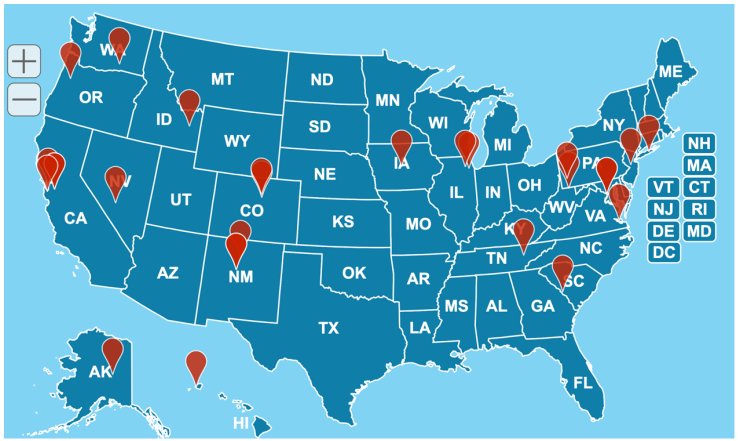






SPECS

DOE National Labs and User Facilities are an Amazing Resource





SPECS

Office of Science Laboratories

Pacific Northwest...

Princeton Plasma...

SLAC National Accelerator...

Fermi National Accelerator...

Lawrence Berkeley...

Oak Ridge National...

Ames Laboratory

Argonne National...

Brookhaven National...

National Nuclear Security Administration Laborat

Lawrence Livermore...

Los Alamos National...

Sandia National...

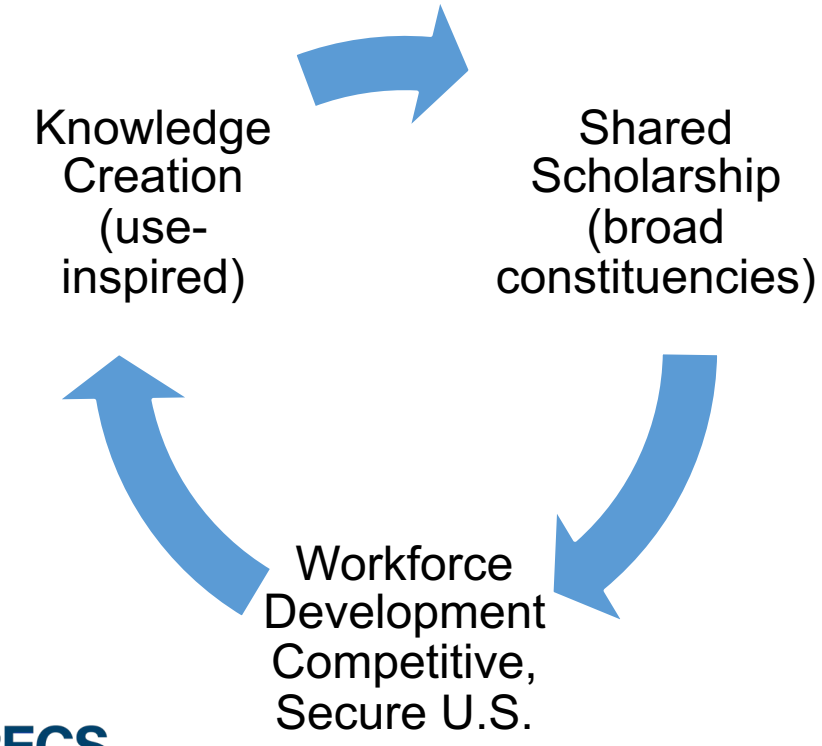
Other Energy Department Office Laboratories

Idaho National Laboratory

National Energy...

National Renewable...

Write proposal in the context of the “MISSION” – R1 Universities and Research Institutes - 2025



Background understanding of what DOE and related agency support can lead to:

49 Ph.D. graduates led to > 0.5 Billion in Economic Impact

e.g. >10M/graduate

Your impact will be bigger!

SPECS

Constructing the proposal – first page(s) are critical!

If I am the reviewer – help me out!!

What is the problem?
What is the approach?
What are the challenges/risk?
What is the impact?

Give me some ‘eye candy” every 1-2 pages – not just for show, summarize the key points with good graphics

SPECS

Center for Soft PhotoElectroChemical Systems (SPECS)

Summary: We propose the formation of the Center for Soft PhotoElectroChemical Systems (SPECS). SPECS' mission is to understand the factors controlling charge and matter transport processes that underpin emerging energy conversion (i.e. catalysis) and energy storage technologies across spatiotemporal scales in highly scalable, durable **π-conjugated polymer materials**. Such materials provide control over local environments afforded through synthesis, long-lived charge carrier lifetimes, and flexible, low-cost, and scalable thin film formats which circumvent the shortcomings of inorganic materials (surface states, grain boundaries, challenges in processing, and mechanically unstable platforms). Yet, investigations into π-conjugated polymer interfaces have been mostly restricted to optoelectronic solid-state devices. Major knowledge gaps currently include: i) understanding and control of interface molecular compositions and structures that dictate charge (electrical and ionic) transport that is ubiquitous across all electrochemical applications; ii) dynamic responses of interfaces and mechanisms that drive (photo)electrochemical charge transfer processes; iii) design guidelines for the creation of robust and durable interfaces that participate in and drive chemical reactions. Insights into materials chemistries for energy storage and molecular fuels production are needed now; an EFRC approach will lead to cohesive understandings of dynamic interfaces throughout these systems. The SPECS team of proven, diverse, and engaged researchers includes synthetic, computational, and experimental experts that will achieve this mission, working across three interconnected thrusts. Initial efforts will focus on π-conjugated (p- and n-dopable) “hairy-rod” polymers.

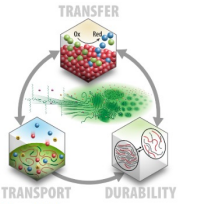


Figure A.1. SPECS research effort is divided into three synergistic thrusts that span fundamental aspects of (photo)electrochemical applications. Insights learned in one thrust readily inform the other two. This approach ensures that the major outcome of SPECS will be a cohesive and holistic understanding of the dynamic interfaces that exist throughout π-conjugated polymer/electrolyte systems, with direct applications to energy storage and molecular fuels generation.

Thrust 1: Hybrid Electrical-Ionic Charge Transport. We will characterize and define the complex atomic-to-nanometer length scale polymer/electrolyte interfaces that control ion and electrical charge transport and storage processes from low to high doping regimes. Manipulation of the chemistry and morphology of these atomic-to-nano-interfaces is essential for new energy conversion and storage chemistries and platforms using these materials, which includes capacitors and batteries.

Thrust 2: Charge Transfer and Energy Cascades. We will learn to control charge-transfer reactivity across π-conjugated polymer/electrolyte interfaces by tuning the local environment at molecular-to-meso-scales to promote selective redox chemistries. The temporal processes of charge and matter transport in (photo)electrode materials ultimately dictate charge transfer kinetics; hence, controlling and balancing these different processes are key to highly-efficient systems for solar fuels generation.

Thrust 3: Durability. We will establish, in parallel with soft material design and characterization, molecular level assessments of functional and environmental durability, leading to systems that simultaneously exhibit high functionality and robust electrochemical performance. Durability ultimately underpins technological relevance. Failure to address durability during design and characterization limits the evolution of materials to incremental advances.

A.1 Impacts and Outcomes of SPECS.

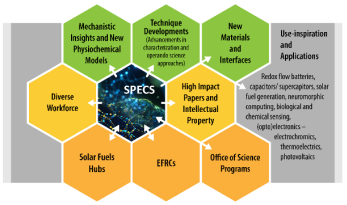


Figure A.2. SPECS will provide fundamental insight into mechanisms and models by developing in situ measurements on new materials and interfaces that will be used towards energy storage and conversion applications. These outputs will directly correlate with a diverse, trained workforce that knows how to effectively communicate and use this new insight. SPECS will collaborate with other DOE Programs to advance both SPECS' and DOE's mission for clean energy.

A direct outcome of SPECS will be **mechanistic insights and new physiochemical models** of fundamental structure-property relationships. Rather than empirical correlations, models based on fundamental chemistry will drive the search for anode and cathode materials **at electrochemically reactive interfaces (catalysis) and buried atomic-to-nano interfaces** that comprise the bulk (storage). These mechanistic insights will only be possible by developing **new measurement science approaches**, which we anticipate will be an equally impactful legacy of SPECS. We will advance characterization and operando approaches, under both environmental and operational “stresses,” to examine materials in near-surface, interface and interphase regions, emphasizing conditions that, in many instances, push materials and platforms far from equilibrium. SPECS will collaboratively develop techniques for π-conjugated polymer/electrolyte interfaces across length (atom-to-meso) scales and across temporal (femptosecond to minute) scales. We are confident that the fundament insights gained by SPECS will translate across Science For Clean Energy applications, including direct connections to existing BES programs, EFRCs, and Hubs focused on energy conversion and energy storage processes. SPECS research products will be disseminated to the greater scientific community through high-impact journal articles and creation of new intellectual property.

Due to the inherent interdisciplinary nature of studies of soft interfaces and the dynamic responses of local π-conjugated polymer/electrolyte interfaces that contribute to volumetric behavior, SPECS naturally sits at the intersection of multiple DOE initiatives and programs (Figure 2). The SPECS EFRC is a direct response to DOE BES initiatives and Basic Research Needs (BRNs) in the Science for Clean Energy reports (i.e. Liquid Solar Fuels and Next Generation Electrical Energy Storage), Directing Matter and Energy: Five Challenges for Science and the Imagination 2007) and Challenges at the Frontiers of Matter and Energy: Transformative Opportunities for Discovery Science (2015). By offering a new entry point into energy conversion and energy storage technologies that complements approaches based on mainly inorganic materials interfaced to molecular catalysts, we anticipate that SPECS will synergistically associate with other DOE-funded major programs that include Center for Hybrid Approaches in Solar Energy to Liquid Fuels (CHASE), Liquid Sunlight Alliance (LiSA), Joint Center for Energy Storage Research (JCESR), Bioinspired Light-Escalated Chemistry (BioLEC), and BES programs in Solar Photochemistry and Materials Chemistry. Collectively, these impacts from SPECS will promote U.S. competitiveness in Basic Energy Sciences in solar fuels and energy storage, which significantly trails parallel materials investments in Europe and Asia.

SPECS is simultaneously committed to the development of a scientifically and demographically **Diverse and Inclusive Workforce**. SPECS directly addresses the Office of Sciences initiatives

Constructing the proposal – first page(s) are critical!

Summary: We propose an effort focused on…….. Our mission is to understand the factors controlling …….. that underpin emerging energy ……technologies using materials that are……... This understanding is predicted to……. Providing design guidelines for …..

Prior investigations into …….have been mostly restricted to …….

Major knowledge gaps currently include:
i) .....
ii)
iii)

This research is extremely collaborative, including synthesis, computation/modeling, advanced spectroscopic…… and partnerships with…..

SPECS

If the work is heavily collaborative in nature, provide an overview of how the project(s) are organized, and what will be the “products”

Table A.1. SPECS team members and specialties. Each team member is mapped on to corresponding thrusts for charge transport (yellow), charge transfer (blue) and durability (green).

Key Investigator	Affiliation	Specialty	THRUSTS		
Erin Ratcliff		Energy- and frequency-resolved spectroelectrochemical approaches, scanning electrochemical cell microscopy (SECCM), laboratory and synchrotron-photoelectron spectroscopies, near-field optical microscopies			
Neal Armstrong		Near-surface composition and electric field distributions using photoelectron spectroscopy			
Jean-Luc Bredas		Quantum-chemical calculations, classical and ab initio molecular dynamics, transport modeling			
Adam Printz		Polymer physics and mechanical strain and durability of polymers			
Elisa Miller	NREL	Electronic structure characterization using XPS, confocal Raman, and PL spectroscopy			
Annie Greenaway		Steady-state and transient spectroelectrochemistry			
Andrew Ferguson		Time-resolved photoluminescence and other time-resolved spectroscopies			
Garry Rumbles		Microwave conductivity spectroscopy			
Seth Marder Durability Thrust Co-Lead		Synthesize and design polymer systems with redox probes			
Mike Toney		Synchrotron-based operando neutron and x-ray scattering and x-ray absorbance			
Steve Barlow		Synthesize and design polymer systems with redox probes			
Obadiah Reid		Transient and Steady-state microwave conductivity and photoluminescence spectroscopy			
Tim Lian Charge Transfer Thrust Lead	EMORY	In situ time-resolved and/or nonlinear spectroscopic studies of charge transfer processes, surface-enhanced raman spectroscopy			
Chad Risko Charge Transport Thrust Lead		Molecular dynamics, quantum chemical, and machine-learning approaches			
Natalie Stingelin		Polymer physics and assembly, thermal analysis, phase diagrams			
Carlos Silva		Nonlinear ultrafast spectroscopy and quantum optics, polymer dynamics			
Jianguo Mei Durability Thrust Co-Lead		Polymer synthesis, degradation chemistry, durability analysis, and scalable manufacturing			
Alberto Salleo		Spectroelectrochemical characterizations of polymers from visible to mid-IR, transmission electron microscopy, polymer packing			

SPECS

Keep chocolate handy!!



Unsuccessful proposal

Successful proposal

