## PROCEEDINGS OF SPIE

## Energy Harvesting and Storage: Materials, Devices, and Applications XII

Palani Balaya Naresh C. Das Editors

3–7 April 2022 Orlando, Florida, United States

6-12 June 2022 ONLINE

Sponsored and Published by SPIE

**Volume 12090** 

Proceedings of SPIE 0277-786X, V. 12090

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in *Energy Harvesting and Storage: Materials, Devices, and Applications XII*, edited by Palani Balaya, Naresh C. Das, Sheng Xu, Proc. of SPIE 12090, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510650565

ISBN: 9781510650572 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

## **Contents**

v Conference Committee

|          | ENERGY HARVESTING AND STORAGE I  |
|----------|--|
| 12090 02 | Thermal effects on the surface of flexible organic photovoltaic solar cells (FOPSC) (Invited Paper) [12090-6]                            |
| 12090 03 | <b>3D</b> electrode architectures for high energy and high power lithium-ion batteries (Invited Paper) [12090-2]                         |
| 12090 04 | A hybrid in-parallel TEG-TPV system for harvesting electrical energy from highly varying high-temperature sources [12090-8]              |
|          | ENERGY HARVESTING AND STORAGE II   |
| 12090 05 | A farm animal kinetic energy harvesting device for IoT applications [12090-14]   |
|          | ENERGY HARVESTING AND STORAGE III  |
| 12090 06 | Non-exponential discharge dynamics in electrochemical capacitors [12090-21]  |
| 12090 07 | Thermal conductivity prediction of nanofluids containing SiC particles by using artificial neural network [12090-28]                     |
| 12090 08 | Hybrid alpha power source [12090-16]   |
| 12090 09 | Novel thermoelectric generator systems for harvesting electrical energy from highly varying and high-peak temperature sources [12090-17] |

Direct battery electrolyte and supercapacitor heating and temperature maintenance at low

**ENERGY HARVESTING AND STORAGE V** 

temperatures [12090-3]

12090 0A

## **Conference Committee**

Symposium Chairs

**Augustus W. Fountain III**, University of South Carolina (United States) **Teresa L. Pace**, L3Harris Technologies, Inc. (United States)

Program Track Chair

Mark A. Itzler, Argo AI, LLC (United States)

Conference Chairs

Palani Balaya, National University of Singapore (Singapore)Naresh C. Das, CCDC Army Research Laboratory (United States)

Conference Program Committee

Paul Boieriu, EPISOLAR, Inc. (United States)

**Deryn Chu**, U.S. Army Research Laboratory (United States)

**Nibir K. Dhar**, U.S. Army Night Vision & Electronic Sensors Directorate (United States)

Achyut K. Dutta, Banpil Photonics, Inc. (United States)

M. Saif Islam, University of California, Davis (United States)

**Nobuhiko P. Kobayashi**, University of California, Santa Cruz (United States)

**Andrew P. Lange**, Lawrence Livermore National Laboratory (United States)

**Hidenori Mimura**, Shizuoka University (Japan)

Jagjit Nanda, Oak Ridge National Laboratory (United States)

**Zunaid Omair**, Stanford University (United States)

**Vijay Parameshwaran**, U.S. Army Research Laboratory (United States)

**Sunmi Shin**, National University of Singapore (Singapore)

**Sivalingam Sivananthan**, EPIR Technologies (United States)

**Ashok K. Sood**, Magnolia Optical Technologies, Inc. (United States)

Patrick J. Taylor, U.S. Army Research Laboratory (United States)

Sudhir B. Trivedi, Brimrose Corporation of America (United States)

Chunlei Wang, Florida International University (United States)

**Priyalal Wijewarnasuriya**, Teledyne Imaging Sensors (United States)

**Sheng Xu**, University of California, San Diego (United States)

٧