

# Polyimide energy storage application

As far as polyimide materials are concerned, although various polyimide dielectric materials with excellent energy storage characteristics have been developed from the perspective of monomers and composites, it is still necessary to rely on innovative ideas to develop polyimide dielectric capacitors with good comprehensive performance.

Enhanced mechanical, thermal and dielectric properties of polyimide nanocomposites containing SiCp (SiCw) nanofillers for high energy-storage applications. Journal of Polymer Research ...

Two new diamines containing three nitriles are synthesized via a 3-step route. They are polymerized with four commercial dianhydrides (i.e. 6FDA, OPDA, BTDA and PMDA) ...

Citation: Maddukuri S, Nimkar A, Chae MS, Penki TR, Luski S and Aurbach D (2021) Na 0.44 MnO 2 /Polyimide Aqueous Na-ion Batteries for Large Energy Storage Applications. *Front. Energy Res.* 8:615677. doi: 10.3389/fenrg.2020.615677. Received: 09 October 2020; Accepted: 15 December 2020; Published: 29 January 2021.

High-Temperature Dielectric Polyimide Films for Energy Storage Applications David H. Wang,<sup>a,b</sup> Brian A. Kurish,<sup>a,b</sup> Imre Treufeld,<sup>c</sup> Lianyun Yang,<sup>c</sup> Lei Zhu,<sup>c</sup> and Loon-Seng Tan <sup>a,\*</sup> <sup>a</sup> Materials & Manufacturing Directorate, Soft-Matter Materials Branch (AFRL/RXAS), Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio 45433-7750

In order to obtain polyimide-based composite materials for energy storage applications, four synthetic methods towards a polyimide matrix with 2 wt.% pristine or acid-functionalized MWCNTs have been developed. The polyimide is derived from a nitrile aromatic diamine and a fluorene-containing dianhydride which allowed the formation of flexible free ...

As the demand for next-generation electronics is increasing, organic and polymer-based semiconductors are in the spotlight as suitable materials owing to their tailorabile structures along with flexible properties. Especially, polyimide (PI) has been widely utilised in electronics because of its outstanding m

Polyimide (PI) is considered one of the most important dielectric materials that can be applied to the high-temperature energy storage field due to its excellent mechanical properties, reasonable dielectric loss, and high breakdown strength.

In this way, a new molecular design of the skeleton structure of PI should be performed to balance size and thermal stability and to optimize energy storage property for high-temperature application.

In recent years, the design of polymer-based multilayer composites has become an effective way to obtain high energy storage density. It was reported that both the dielectric constant and breakdown strength can be

# Polyimide energy storage application

enhanced in the P(VDF-HFP)-BaTiO<sub>3</sub> multilayer composites [7]. And the maximum energy storage density in the multilayer samples ...

In this regard, polyimide (PI)-based electrodes have emerged as a promising avenue for the development of post-lithium energy storage systems. This review article provides a comprehensive summary of the syntheses, characterizations, and applications of PI compounds as electrode materials capable of hosting a wide range of cations.

Polyimide (PI) turns out to be a potential dielectric material for capacitor applications at high temperatures. In this review, the key parameters related to high ...

The exploration of cathode and anode materials that enable reversible storage of mono and multivalent cations has driven extensive research on organic compounds. In this regard, polyimide (PI)-based electrodes have emerged as a promising avenue for the development of post-lithium energy storage syst ...

**Keywords:** polyimide, thermal property, dielectric property, energy storage, nanocomposites 1. Introduction With the rapid development of the global economy and a rising population, the search for efficient and clean energy and energy storage technologies has become a priority worldwide. Because of its exceptionally fast energy conversion rate, long

Dielectric energy storage capacitors with excellent high temperature resistance are essential in fields such as aerospace and pulse power. However, common high-temperature resistant polymers such as ...

High-temperature dielectric polymers have a broad application space in film capacitors for high-temperature electrostatic energy storage. However, low permittivity, low energy density and poor thermal conductivity of high-temperate polymer dielectrics constrain their application in the harsh-environment electronic devices, especially under elevated temperatures.

The electrical energy storage of dielectrics relies on the application of an external electric field (E) on the dielectric layer to generate an electrical displacement (D,  $D = \epsilon_0 \epsilon_r E$ ,  $\epsilon_0$  ...

With the development of electronic technology, there is an increasing demand for high-temperature dielectric energy storage devices based on polyimides for a wide range of applications. However, the current nanofillers/PI nanocomposites are used for energy harvesting at no more than 200 °C, which does not satisfy the applications in the oil and gas, aerospace, ...

With the wide application of energy storage equipment in modern electronic and electrical systems, developing polymer-based dielectric capacitors with high-power density and rapid charge and discharge capabilities has become important. However, there are significant challenges in synergistic optimization of conventional polymer-based composites, specifically ...

# Polyimide energy storage application

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This chapter presents an overview of recent progress on PI dielectric materials for high-temperature capacitive energy storage applications. In this way, a new molecular design of the skeleton structure of PI should be performed to balance size and thermal stability and to optimize energy storage property for high-temperature application ...

Dielectric capacitors with a high operating temperature applied in electric vehicles, aerospace and underground exploration require dielectric materials with high temperature resistance and high energy density. Polyimide (PI) turns out to be a potential dielectric material for capacitor applications at high Energy and Environmental Science Recent ...

This research not only showcases a model for designing polyimide nanocomposites for energy storage and insulation but also offers a viable solution for their large-scale industrial production. ... Inorganic dielectric materials for energy storage applications: a review. *J. Phys. D App. Phys.*, 55 (18) (2022), 10.1088/1361-6463/ac46ed.

Consequently, the breakdown strength and dielectric constant are improved synergistically, leading to an enhancement in the energy density. The work provides a new paradigm to explore polyimide nanocomposites with enhanced energy density based on the combination of experiments and simulations. 1. Introduction

**ABSTRACT** Recently, PI as high-performance polymer with high glass transition temperature have been regarded as promising matrix for high-temperature dielectric nanocomposites. As such, the review aimed to summarize the influence of nanoceramic fillers on the characteristics of polyimide-based nanocomposites for high-temperature energy storage. ...

Lithium-ion batteries (LIBs) have helped revolutionize the modern world and are now advancing the alternative energy field. Several technical challenges are associated with LIBs, such as increasing their energy density, improving their safety, and prolonging their lifespan. Pressed by these issues, researchers are striving to find effective solutions and new materials ...

Polyimide (PI) has attracted lots of attention because of its high breakdown strength, excellent heat-resistance, simple synthesis process and easy designability of its molecular structure, which make it a great potential high-temperature dielectric material.

The optimization of high-temperature polyimide dielectric materials should balance all aspects of properties, such as thermal stability, dielectric properties, mechanical ...

In light of the increasingly stringent requirements for the applications of light-weight flexible high-temperature-resistant dielectric materials in the fields of aerospace, electronics, and electric vehicles, the

## Polyimide energy storage application

imperative lies in the development of dielectric materials with high discharged energy density, enduring temperature resistance and high reliability. This work ...

High energy density of polyimide films employing an imidization reaction kinetics strategy at elevated temperature. *J. Mater. Chem. A*, 10 ... High-k polymer nanocomposites with 1D filler for dielectric and energy storage applications. *Prog. Mater. Sci.*, 100 (2019), pp. 187-225, 10.1016/j.pmatsci.2018.10.003.

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