

nature insight

Materials for clean energy



Cover illustration

Depleting supplies of fossil fuel and increasing future energy demands will require development of alternative 'clean' energy technologies, such as the solar panels shown in the background. (Images courtesy of M. Xeridat/J. Sullivan/Getty Images.)

Increasing awareness of environmental factors and limited energy resources have led to a profound evolution in the way we view the generation and supply of energy. Although fossil and nuclear sources will remain the most important energy provider for many more years, flexible technological solutions that involve alternative means of energy supply and storage need to be developed urgently.

The search for cleaner, cheaper, smaller and more efficient energy technologies has been driven by recent developments in materials science and engineering. The aim of this collection of reviews is therefore to focus on what materials-based solutions can offer and to show how the rational design and improvement of chemical and physical properties of these materials can lead to energy alternatives that can compete with existing technologies.

The most pronounced breakthroughs are currently taking place for technologies using renewable energy sources, such as fuel cells and solar cells. At the same time, the use of these technologies requires reliable and effective ways of storing energy, and exciting developments are occurring in the fields of hydrogen storage, rechargeable batteries and high-temperature superconductivity.

Exploring all the options under consideration would be impossible in such a collection. But we hope that these articles provide a flavour of the many scientific and technological challenges and future opportunities offered by alternative energy sources, as well as illustrating the multidisciplinary nature of the endeavour. Much work remains to be done before they start competing with conventional sources, but if we want continued prosperity and energy security while enjoying a safer and cleaner environment, we must face up to our responsibilities and ensure that these technologies start affecting our everyday life sooner rather than later.

We are pleased to acknowledge the financial support of the Materials Research Society in producing this Insight. As always, *Nature* has sole responsibility for editorial content and peer review.

Vincent Dusastre Senior Editor

overview:

332 Alternative energy technologies

M. S. Dresselhaus
& I. L. Thomas

review articles:

338 Photoelectrochemical cells

M. Grätzel

345 Materials for fuel-cell technologies

B. C. H. Steele
& A. Heinzel

353 Hydrogen-storage materials for mobile applications

L. Schlapbach
& A. Züttel

359 Issues and challenges facing rechargeable lithium batteries

J.-M. Tarascon
& M. Armand

368 High- T_c superconducting materials for electric power applications

D. Larbalestier,
A. Gurevich,
D. M. Feldmann
& A. Polyanskii

Editor, *Nature*: Philip Campbell
Insight Editors: Vincent Dusastre
Karl Ziemelis

Editorial Assistant: Simon Gibson
Production Editor: Simon Gribbin
Art Director: Majo Xeridat

Diagrams: Ann Thomson
Production Manager: Yvonne Strong
Sponsorship: Emma Jones