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Mapping the landscape of scientific research in emerging nano-energy field

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The conventional research field of energy and the emerging field of nanotechnology integrate together and breed a promising multidisciplinary field of nano-energy. Nano-energy research dedicates to improving existing or developing new approaches to energy production, storage, conversion and usage with ultra-high efficiency and minimum environment impact. In the context of increasingly acute worldwide shortages of energy supplies and environment issues, the importance of nano-energy research is clearly growing day by day. Scientific literatures on nano-energy, as a part of research performance, also have remarkably increased in recent years. However, few studies have quantitatively investigated the research performance on nano-energy from a multi-dimensional and longitudinal perspective so far to the knowledge of us. Thereby, our purpose in this paper is to comprehensively explore nano-energy scientific research profiles during 1991-2012 based on bibliometric method and social network analysis technique. We firstly investigate the growth pattern of literatures on nano-energy research, and then carry out cross-country comparisons on its quantities and qualities of top ten productive countries. Moreover, we build international scientific collaborative networks for three four-year intervals respectively to examine international collaborative profiles in nano-energy field. Our main finds can be summarized as follows: (1) Scientific research output of nano-energy presents emerging discipline's impressively exponential growth pattern. (2) As measured by nano-energy literatures' quantities and qualities of top ten most productive countries, USA invariably holds a dominant position in nano-energy research field during 1991-2012. China becomes a new major contributor in this field. Because China has exceeded several European countries and it is also gradually catching up with USA in research performance. (3) Across three four-year intervals, international collaborative intensities of the analyzed countries are relatively high, especially for five European countries. Besides, USA and certain European countries dominate the international collaborative network, however the network is rapidly expanding worldwide and China has become the most closely bilateral collaborator for USA.

Biography

Jiancheng Guan is a Professor at School of Management, University of Chinese Academy of Sciences. His teaching and research areas include Innovation Management and Management of Technology. He has published more than 50 papers in international journals such as Research Policy, Technovation, Technological Forecasting and Social Change, Journal of the American Society for Information Science and Technology, Journal of Informetrics, Scientometrics, Journal of Nanoparticle Research, Technological Analysis and Strategic Management, R&D Management, Research-Technology Management, International Journal of Technology Management, China Economic Review etc. He also published numerous papers in Chinese domestic core academic journals. He has won several research awards as Principal investigator (Ranking first) issued by Chinese Education Ministry, Chinese Aviation Ministry, Beijing Municipality in the field of innovation management.

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Light-harvesting scheme in optoelectronic devices

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It is of current interest to develop the photon management with nanostructures since the ability to suppress the reflection and light trapping over a broad range of wavelengths and incident angles plays an important role in the performance of optoelectronic devices, such as photodetectors, light-emitting diodes, optical components, or photovoltaic systems. Superior light-trapping characteristics of nanowires, including polarization-insensitivity, omnidirectionality, and broadband working ranges are demonstrated in this study. These advantages are mainly attributed to the subwavelength dimensions of the nanowires, which makes the nanostructures behave like an effective homogeneous medium with continuous gradient of refraction index, significantly reducing the reflection through destructive interferences. The relation between the geometrical configurations of nanostructures and the light-trapping characteristics is discussed. We also demonstrated their applications in solar cells and photodetectors. This report paves the way to optimize the nanostructured optoelectronic devices with efficient light management by controlling structure profile of nanostructures.

Biography

Jr-Hau He is an Associate Professor at Institute of Photonics and Optoelectronics & Department of Electrical Engineering, National Taiwan University. He puts all his efforts into the design of new nanostructured architectures for Nanophotonics and the next generation of nanodevices, including Photovoltaics (PV), and Resistive memory. He has won a lot of awards and honors with his students in professional societies and conferences in Taiwan and internationally.

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