



Review

Materials 4.0: Materials big data enabled materials discovery

Rajan Jose^{a,*}, Seeram Ramakrishna^{b,c,d}^a Nanostructured Renewable Energy Materials Laboratory, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Malaysia^b Department of Mechanical Engineering, National University of Singapore, Singapore^c Institution of Engineers, Singapore^d SPRING Singapore, Singapore

ARTICLE INFO

Article history:

Received 23 September 2017

Received in revised form

29 December 2017

Accepted 30 December 2017

Keywords:

Materials artificial intelligence

Materials informatics

Materials waste management

Materials cyberinfrastructure

Materials genomics

ABSTRACT

Materials discovery is an incessant process and has been the landmark of human progress. This article sees the evolution of materials discovery in generations, its current generation as the fourth paradigm of materials research and term it as Materials 4.0, briefly describe the built-up infrastructure for the Materials 4.0, and cite few examples of materials discovery and lifecycle assessment under this protocol.

© 2017 Elsevier Ltd. All rights reserved.

Contents

1. Introduction	127
2. Evolution of materials research – an analogy with industrial revolutions	128
3. Data are the primary resources for Materials 4.0	129
3.1. Materials big data informatics has been set up throughout to facilitate Materials 4.0	129
4. Materials 4.0 on the go	130
4.1. Prediction of properties, design, and discovery of novel materials	130
4.2. Life cycle assessment and materials recovery	131
5. Conclusions and outlook	131
Acknowledgements	132
References	132

* Corresponding author.

E-mail addresses: rjose@ump.edu.my (R. Jose), seeram@nus.edu.sg (S. Ramakrishna).