Evaluated Materials Property Data

The internet has become the resource of first choice for technical materials information. The lack of publication constraints in this medium, however, poses a serious problem regarding the quality of the information retrieved from unqualified sources. The U. S. National Research Council, CODATA International, ISO (the International Organization for Standards), and ASTM International have separately indicated the urgent, timely, and persistent need for evaluated data and for standards, protocols, or tools by which the reliability of such information sources can be assessed.

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Representations of Data: Real-time simulations of materials behavior and product performance demand property data as a function of temperature and as a function of material characteristics such as porosity. Traditionally, such data have been available in tabulations of property values. Discrete compilations, however, can be cumbersome to use in automated computations, particularly if the computational algorithms and the data are on different computers. Furthermore, discrete compilations are subject to inconsistencies in value selection criteria when the operating point is not one of the discrete values in the discrete set. Analytic representations can resolve this problem and provide additional value-added assessments.

A study addressing this issue for elastic moduli data has been completed using an analytical model that provides a self-consistent representation of the simultaneous temperature and porosity dependence of the elastic and bulk moduli of polycrystalline ceramics. The data for 24 oxide ceramics were obtained from the Ceramics WebBook collection, NISTIR 6853, compiled previously in this project.

Data Evaluation Tool: The central theme developed in the NIST Recommended Practice Guide, SP960-11, is that the function of data evaluation is to ascertain the credibility of data. Based on the analysis given in that Guide, we have used hypertext markup language (HTML) to implement an interactive protocol according to which materials property data can be assessed and classified into seven different levels of acceptable data. This tool, accessible *via* the Ceramics WebBook (http://www.ceramics.nist.gov/IDELA/IDELA.htm), leads the user through a series of questions in the manner of a decision tree. Upon reaching a conclusion, the tool presents a summary of the decision sequence along with the determined data evaluation level.

Data and Informatics Needs in Biomaterials: Used in medical devices, biomaterials are natural or artificial materials that interact with biological systems to replace or augment the function of living tissue. In addition to nonviable medical implants, biomaterials are also found in tissue engineering and artificial organ applications where living cells are used.

With an estimated 13 % annual growth rate, biomedical devices and the materials from which they are made represent one of the fastest growing segments of both the biotechnology and materials industries. Approximately 8 % to 10 % of the U.S. population has a medical implant; examples include: intraocular lens, heart valve, pacemaker, coronary/vascular stent, breast implants, and joint prosthesis. Even more common biomaterials include contact lenses, dental amalgams, sutures, and edible coatings for drug tablets or capsules. Hence virtually every American at some point consumes biomaterials.

Biomaterials property data are widely scattered across the relevant literature and the internet. However, because few standards exist for biomaterial property measurement, these data often are not directly comparable. As a result, there are few biomaterials property databases: the only known online source documents properties of primarily dental materials; three other databases contain biomolecular structural data. The data from these printed and electronic sources are used to characterize biomaterials, to design biomedical devices, to screen or select materials for biomedical applications, to simulate biomaterial performance, to develop protocols for the synthesis of biological macromolecules, and to substantiate hypotheses and theory.

An assessment of the data and informatics needs in biomaterials is presently under development. The study will address the primary issues, needs, barriers, and opportunities surrounding biomaterials property data and also will examine the key players and their roles in biomaterials technology. Research highlights, resources, and data delivery mechanisms will serve to inform and guide future efforts in this burgeoning field.

Contributors and Collaborators

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