

AN ENGINEERING MATERIALS LAB MANUAL ON CD-ROM

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ABSTRACT

The National Educators' Workshop (NEW:Update) series of workshops has been in existence for the past twelve years. The annual workshops focus on technical updates and laboratory experiments for materials science, engineering and technology, involving new and traditional content in the field. Scores of educators and industrial personnel have contributed 213 experiments and demonstrations for demonstration then publication as NASA Conference Proceedings. Through a collaborative effort among education, industry, and national laboratories, all of the experiments from the first ten years of NEW:Updates are now available for easy use on CD-ROM in the popular Acrobat Reader format; the same format used for the Annual ASEE Conference Publications CD-ROM.

This presentation provides an overview of the now completed *Experiments in Materials Science, Engineering and Technology CD-ROM (EMSET CD-ROM)* and a tutorial of how to use the CD-ROM to support teaching of materials science, engineering, and technology. The 213 experiments and demonstrations are indexed under the following categories:

Testing and Evaluation, Polymers, Metals, Ceramics,
Composites, Electronic Materials, and Materials Curriculum.

The CD-ROMs operate on most popular computer platforms. An additional CD-ROM provides videos on Scanning Tunneling and Atomic Force Microscopy, High Performance Polymers, Advanced Ceramics, and Advanced Composites.

INTRODUCTION

The National Educators' Workshop series (**NEW:Update**) of workshops has been in existence for the past eleven years. The activities focus on technical updates and laboratory experiments for materials science, engineering and technology, involving new and traditional content in the field.

The National Aeronautic and Space Administration (NASA), the Department of Energy (DOE), National Institute of Standards and Technology (NIST), and Norfolk State University (NSU), have provided the major funding for these workshops. Joining in the support are the American

Society for Engineering Education, ASM International, American Society for Testing & Materials, Battelle, Pacific Northwest Laboratory, Boeing Airplane Company, Ford Motor Company, Martin Marietta Energy Systems, Inc., and the Materials Education Council of the United States.

Annual NEW:Updates & Publications

NEW:Updates focus on strengthening materials education. Participants witness demonstrations of experiments, discuss issues of MSE (materials science and engineering) with people from education, industry, government, and technical societies, and hear about new MSE developments. Half-day mini workshops in small groups are conducted in state-of-the-art laboratories at the host laboratories including NASA Langley Research Center, National Institute of Standards and Technology, Oak Ridge National Laboratory, Los Alamos National Laboratory, and Boeing Airplane Company - Seattle.

The experiments are developed by faculty, scientists, and engineers throughout the United States. There is a blend of experiments on new materials and traditional materials. For the first decade of NEW:Updates, scores of these contributors provided 213 experiments that cover the full range of topics and levels of education on materials engineering and technology.

An extensive peer review process of experiments is followed. After submission of abstracts, selected authors are notified of their acceptance and given the format for submission of experiments. Experiments are reviewed by an international panel through the cooperation of the Materials Education Council. Authors received comments from the panel prior to workshops allowing them to make necessary adjustments prior to demonstrating their experiments.

Participants who attended NEW:Updates, observe demonstrations of the experiments and provide critiques for the authors to make further modifications prior to this publication. Final editing is done by the publication staff of the National Aeronautics and Space Administration.

CD-ROM Compendium

After several years of NEW:Updates and the popularity of the experiments resulting from the meetings, especially by the Materials Division of ASEE, the organizing committee began work on a compendium of selected experiments. Support for the compendium came from a broad range of individuals, agencies, and technical societies, much like the support for NEW:Updates.

The original idea aimed to produce hard copies of about 50 selected experiments. However, at NEW:Update 94, Alfred and Evelyn McKenney and Robert Berrettini presented a concept by which all experiments could be placed on a CD-ROM in a format that would provide materials educators an easy manner to use any of the 213 experiments. Additionally, they could customize the experiments to meet their students' needs. After several years of further research on methodology and efforts to secure funding, we finally were able to put together a project that used several sources of funds, much volunteer help and resources, and a publisher who would mass produce and package CD-ROMs from the master and distribute them.

The structure of the CD-ROM allows materials educators to manipulate individual papers in a

variety of ways for both hard copy or digital outputs. They can edit their selection to fit their own environment and to suit their students' needs. The movies can be viewed individually or presented as a part of a lecture, and provide insights into emerging materials science topics.

The CD-ROMs resulted from a outpouring of collaboration from a national network of materials educators, engineers, and scientist involved in the first decade of annual National Educators' Workshops. Their contributions are now available for anyone to benefit from for evermore. The following provides a tutorial on how to use the *Experiments in Materials Science, Engineering and Technology CD-ROM*.

EMSET TUTORIAL

This first digital collection of the National Educator's Workshop: Standard Experiments in Engineering Materials, Science, and Technology (NEW:Update) experiments includes papers published during the first ten years of the annual workshop compendiums. They have been reproduced in their original peer-reviewed form, preserving the individuality among the papers and reflecting the author's style and method. We have combined the convenience and capacity of the CD-ROM with the power of the Adobe Acrobat document format. The result is a medium for these experiments which provides better support to your classroom and laboratory needs.

There are some video clips on the *EMSET CD-ROM*. Of additional interest to you and your students will be the Video Supplement bonus disk included in this package. This second disc contains video segments on new and emerging concepts in materials science and engineering.

The Acrobat Reader gives you the ability to:

- View an exact image of the original paper,
- Read, or print the paper, or copy its text into another document for editing,

To find the document(s) meeting your needs, you can:

- Browse the Table of Contents which is organized by types of materials or processes, or
- Use the full Text Search capability, searching by:
 - Author
 - Title
 - Subject
 - Text words in context

You will probably find yourself using the Full Text Search more often than the Table of Contents because the subject matter of papers sometimes fit into more than one category.

In many cases, you will probably use the experiments as they were published. However, you may sometimes wish to edit a paper for a particular need. You can use the Acrobat Exchange program. However, if you do not have access to this program, there are two other methods of editing to chose from:

- Print the paper, then cut and paste as needed. You all know how to do this. - or,
- Copy blocks of text and graphics to the clipboard, then paste into a word processor or graphics program.

The following procedures will give you experience with the second method.

Procedures

Follow the printed instructions to start the *EMSET CD-ROM* and go to the Main Menu.

Now we will walk you through a tutorial to give you experience on how to select material from two specific papers and prepare a composite paper for use in your classroom or laboratory. The final paper will contain excerpts from an experiment by Ed Widener, *It's Hard to Test Hardness* and a companion experiment by Ed's Purdue colleague, Patricia Olesak, *Scleroscope Hardness Testing*.

1. Finding the Papers

From the **Main Menu**, select the **Table of Contents** button. The result is shown in Figure 1.

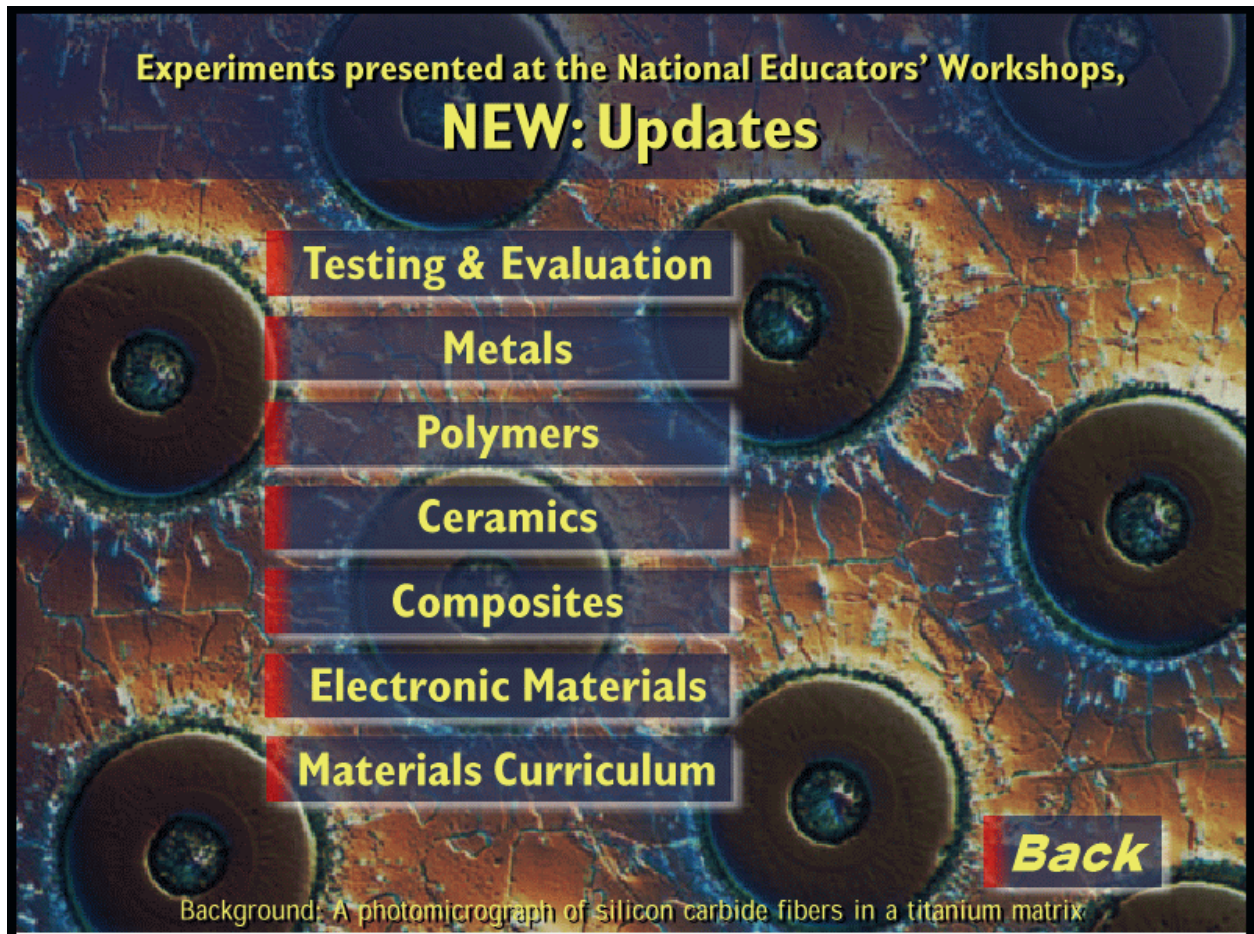


Figure 1

Next, select the **Testing & Evaluation** button.

When the Testing & Evaluation Table of Contents appears, browse the list of authors and papers, and you will locate entries for Ed Widener and Patricia Olesak's papers. If we had not known the exact titles of the papers or even the authors, we could have used the Full Text Search facility to find the papers we wanted. For example, by entering "hardness" or "hardness testing" or the authors' names in the Adobe Acrobat Search window, we would quickly find both of the papers we wanted. See Figure 2.

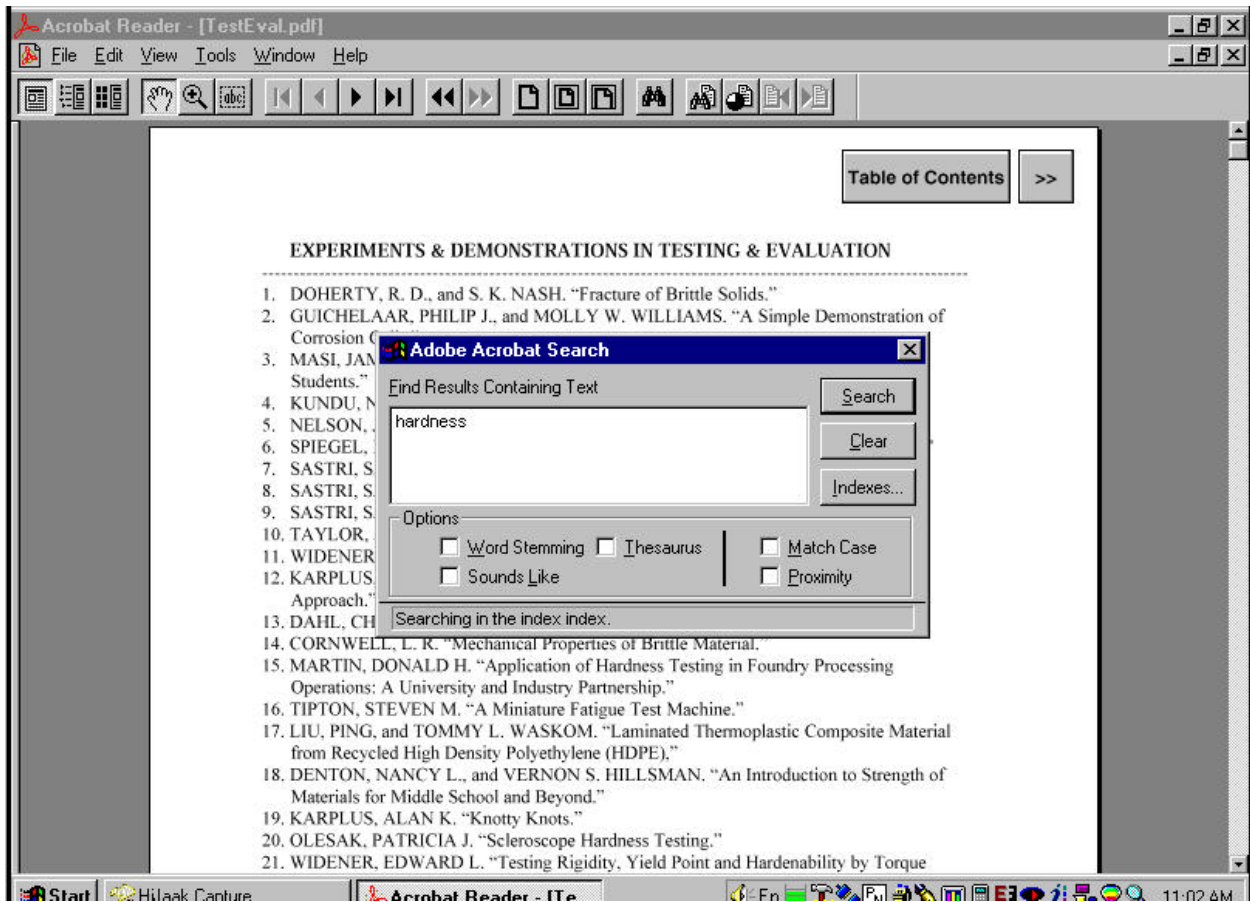


Figure 2

Select the first paper, Ed Widener's, *It's Hard to Test Hardness*. See Figure 3.

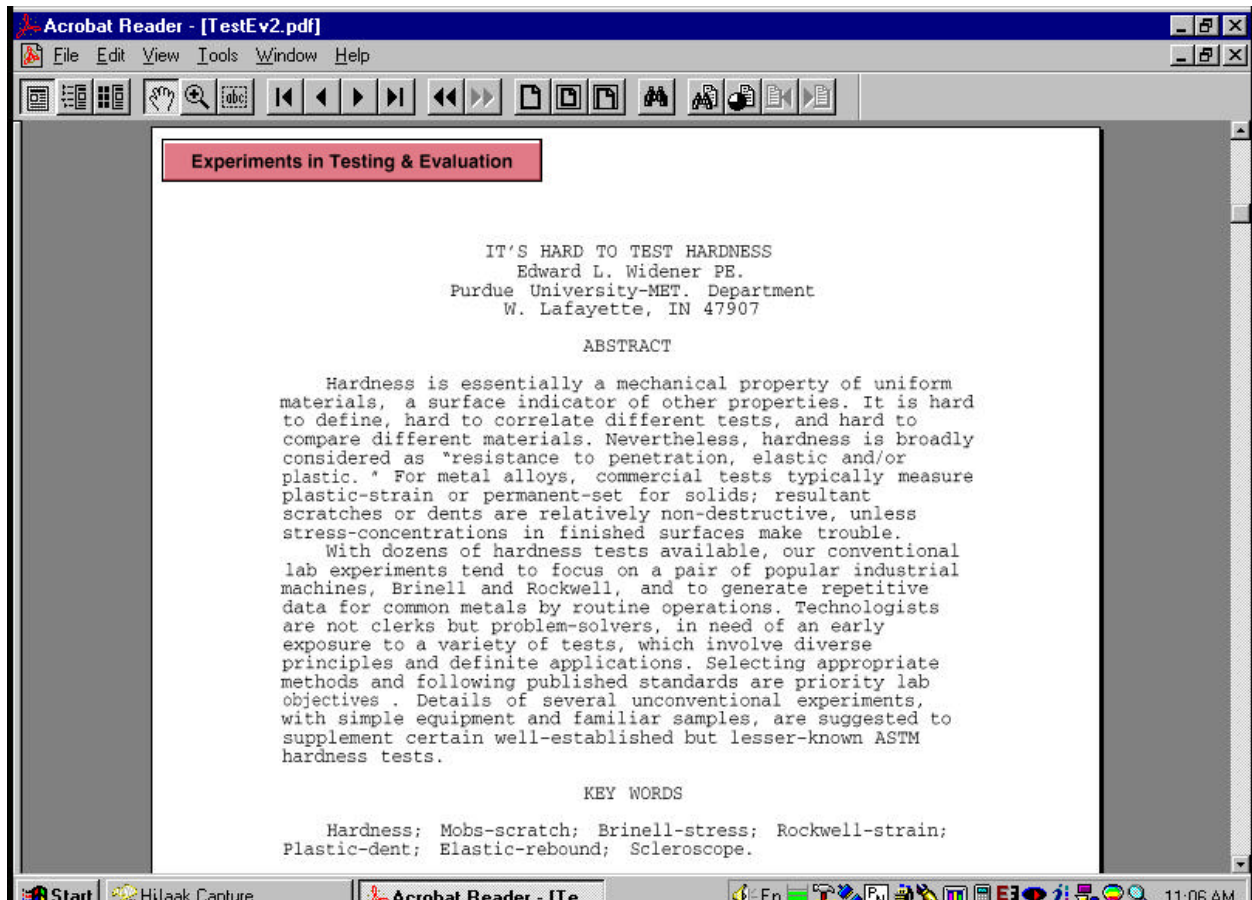


Figure 3

2. Copying Text Material from the First Paper

When the paper appears, read it and select the text you want to include in the composite paper. Chose the Select Text Tool from the Tools Menu. Use the text cursor to highlight the desired text. Note that you can only select one block of text or graphic to Copy at one time. The maximum size is limited to the current page.

Use the Copy command to copy the selected text to the Clipboard.

Next, open your word processor and Paste the text from the Clipboard to your New Document.

3. Copying Graphic Material from the First Paper

Return to Ed Widener's paper and Copy any additional material required to the Clipboard. For example, we want to include his Figure II. Since this is a graphic, it is necessary to chose the Select Graphics Tool. Use the Graphics Tool to draw a box around the object desired (Figure II) and Copy the figure to the Clipboard.

Paste the Figure stored on the Clipboard to the appropriate location in your New Document.

4. Copying Material from the Second Paper

Return to EMSET and press the **Experiments in Testing & Evaluation** button to return to the Testing and Evaluation Table of Contents.

Select Patricia Olesak's paper, *Scleroscope Hardness Testing*.

Select the items desired from this paper, as you have done before. Copy the items and Paste them in the appropriate locations in your New Document in the word processor.

5. Editing the Final Paper

When all of the material desired has been copied into the word processor, you can add your own text and edit it as desired for your final composite paper. You may develop a lab report form to suite you students' needs. For example, you could include a Brinell Hardness Test Data Sheet such as Figure 4.

TMD145 Brinell Hardness Test Data Sheet				
Student Name _____		Date _____		
Sample #	Material Description	Load (KgF)	Dent Dia (mm)	BHN
1				
2				
3				
4				
5				

Figure 4

Remember to credit the original authors for their fine contributions.

It is important to note that while the Clipboard transfers graphics with 100% accuracy, it does not always transfer text so accurately. Therefore, it is advisable to check and correct the text formatting and spelling before starting your editing.

Reference Material

Finally, to assist in finding your way around *EMSET*, you may wish to print out the *Getting Started* section to use as a reference. To do this, select the **Getting Started** button from the Main Menu. After *Getting Started* appears, select and execute **Print** from the File Menu.

Acknowledgments and Fair Use

This CD-ROM resulted from scores of people contributing experiments and demonstrations to the first decade of National Educators Workshop: Updates in Engineering Materials, Science, and Technology (NEW: Updates) ; their names are listed with their experiments on the CD-ROM, as are the many other people and agencies who helped in this project. Cooperative funding among

private industry, academia, and NASA allowed for production of the CD-ROM master, with the understanding that production and distribution would be done by a publisher. Prentice-Hall, Inc. agreed to become the publisher.

The *EMSET CD-ROM* is licensed for departmental use. Faculty have the right to cut and paste papers from the CD-ROM to suit their needs. However, users should give credit to the original authors.

Ordering Information

To order departmental or individual copies of *EMSET CD-ROM*, ISBN 0-13-648486-7; call Prentice-Hall at 1-800-922-0579; visit their web site at www.prenhall.com; or send a purchase order to Prentice-Hall, Order Processing Dept. 200, Old Tappan Rd, Old Tappan, NJ 07675. Academic price \$150. Registration of the your license will insure upgrades at a reduced rate. The plan is to update *EMSET CD-ROM* every other year with the additional experiments from NEW:Updates.

BIOGRAPHICAL INFORMATION

James A. Jacobs is Professor of Engineering Technology at Norfolk State University. He developed the concept and has been co-director of all the NEW:Updates. He has thirty-three years of teaching experiences in public schools, community colleges, and universities. He has developed curricula offerings at all three levels, including courses in material science, materials and processes technology, engineering materials technology, and principles of manufacture.

He has industrial experience with Westinghouse Corp., Tenneco, Ford Motor Co., and completed an intensive ten-week program with International Business Machines Manufacturing Technology Institute.

He is the author of numerous articles, books, and technical papers/ presentations. Dr. Jacobs co-authored *Engineering Materials Technology*, now in its third edition, and the CD-ROM set, *Experiments in Materials Science, Engineering and Technology* both published by Prentice-Hall Inc. He has been involved as consultant and director with numerous grants, seminars, and curriculum development efforts in engineering materials, manufacturing, robotics and CAD/CAM.

Professor Jacobs is a member of the Materials Education Council of the U. S.; ASM International; Society of Manufacturing Engineers; American Society for Engineering Education; American Association of University Professors; American Ceramics Society, and is a Certified Senior Technologist and member of the National Association for Industrial Technology.

Alfred E McKenney received his B.S. in engineering from the US Coast Guard Academy at New London, Connecticut. After service as a line officer, he earned his MBA at Harvard Business School. He was employed by IBM for 37 years where he specialized un the design of large manufacturing systems.

In 1987, he was assigned by IBM on a two-year sabbatical to the School of Technology at Norfolk State University where he taught courses in computing, tool design, mechanics, engineering material technology robotics, CIM and production planning and inventory control. On retiring from IBM, he continued teaching for two more years at Norfolk State, as well as working with Dr. Jacobs on NEW:Update. He is now enjoying retirement and occasional independent consulting with his wife, Evelyn.