

Current Comments®

EUGENE GARFIELD

INSTITUTE FOR SCIENTIFIC INFORMATION®
3501 MARKET ST., PHILADELPHIA, PA 19104

ISI's New *Materials Science Citation Index* on CD-ROM, with Abstracts, *Related Records*, and *KeyWords Plus*

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ABSTRACT

The *Materials Science Citation Index*™ on CD-ROM, a new specialty index launched by the Institute for Scientific Information®, is discussed. The index contains searchable author abstracts, *KeyWords Plus*™, author keywords, and *Related Records*™. The historical evolution of the field is described, along with recent advances in materials science, and the searching features of the product. The new index joins the Biotechnology, Neuroscience, Chemistry, and Biomedical Engineering series of specialty indexes announced within the last year.

Two weeks ago, I described our new *Biomedical Engineering Citation Index*™ on CD-ROM.¹ Biomedical engineering is one of many fields of research that has experienced sustained growth over the last several decades. Another multidisciplinary field that has shown steady growth, and at times even explosive growth, is materials science. We recently launched the *Materials Science Citation Index*™ (*MSCI*™) to cover the literature in this field. This is the fifth such service launched by the Institute for Scientific Information® (ISI®) within the last year. The other databases cover biotechnology, neuroscience,² and chemistry.³

Materials science is a relatively new term in the lexicon of science. The term was first used about 40 years ago.⁴ This may surprise some readers since we have all dealt with "materials" for so long. More than 10,000 years ago, crude tools made from materials like bone, wood, and stone preceded the primitive arts of smelting, alloying, and the firing of ceramics.

Materials science and engineering today involves the study of the fundamental nature of materials, both natural and synthetic, and their practical applications.⁵ The field consists of a wide-ranging mosaic of disciplines, not the least of which is the hot subfield of biomaterials. The traditional disciplines of chemistry, physics, metallurgy, and ceramics are central to this science.

They are joined by newer specialties, such as semiconductor physics, nuclear chemistry, biotechnology, and superconductors. A superconductor can be a metal, a polymer, a ceramic, or a combination thereof. Consequently, the scope of the *Materials Science Citation Index* extends not only to metals, alloys, ceramics, and glass, but also to composites, polymers and elastomers, fibers, textiles, paper, and wood. These materials have many large-scale industrial applications—for example, in building and electrical materials.

Recent Advances in Materials Science

One could describe a litany of multidisciplinary advances involving materials science. More recent examples include the development of glass fiber lenses with microscopically narrow channels. These lenses focus beams of neutrons for use in materials science.⁶ Another was a report by Philip Mitchell on the use of electrochemical techniques to shape ceramics.⁷

Current Contents® readers may recall an essay on the 1987 Nobel Prize for physics awarded to K.A. Müller and J. Georg Bednorz of the IBM Zurich Research Laboratory, Rüschlikon, Switzerland.⁸ They discovered "superconductivity in a ceramic material at a temperature significantly higher than had previously been achieved. This discovery triggered a worldwide ex-

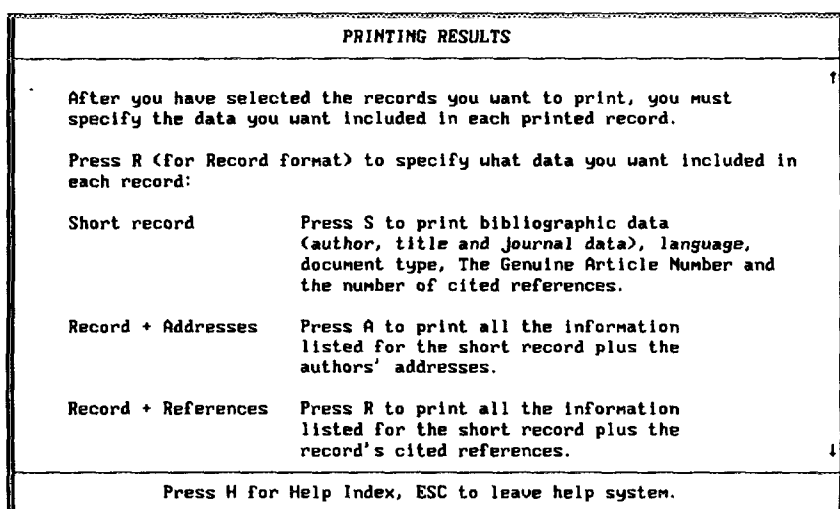


Figure 1. A portion of the help menu explaining print options.

plosion of research that led to the development of materials that superconducted at even higher temperatures.⁹ (p. 1336) The Müller-Bednorz work involved a ceramic material consisting of lanthanum, barium, copper, and oxygen. Their discovery promises to open up many practical applications of superconductivity at reasonable prices.¹⁰

The impact of materials science is well exemplified in the ubiquitous computer chip made of silicon—the most common element on earth. The oxides of silicon are found in sand and quartz. Semiconductor integrated circuits are a prime example of materials science.

Of course, not all computer chips are made of silicon. Some supercomputers use gallium arsenide. Electrons travel five times faster in this material than in silicon. However, silicon is much cheaper than gallium arsenide. Researchers have been trying to combine both materials to achieve high performance and economy.⁴

ISI's Special Search Features

The *MSCI* covers more than 400 of the world's core journals in materials science, including 109 periodicals not found in the *Science Citation Index*®. In addition, it selectively covers thousands of other jour-

nals from ISI's huge database. Articles are selected by editors familiar with the field, aided by computer algorithms based on a variety of selection criteria. Annual coverage will include 80,000 to 90,000 source papers and other editorial items, together with author abstracts in English. Since the average item contains about a dozen references, this index will include nearly a million citations.

All of the specialty citation indexes in this series are updated bimonthly. Each subsequent issue builds to an end-of-year cumulation. The first *MSCI* compact disk covers January to April of 1992. And, a cumulative disk for 1991 also is available.

The paramount objective of these specialty indexes is to provide the specialist desktop access to a database that is unique in a number of ways. These databases permit you to conduct focused yet comprehensive literature searches.

The navigational possibilities within the *MSCI* are also unique. I've discussed our *KeyWords Plus*™^{11,12} and *Related Records*™¹³ options before. In 1991, we introduced searchable author abstracts to the ISI databases. These features, used in combination with author keywords, title words, journal, cited reference, and address

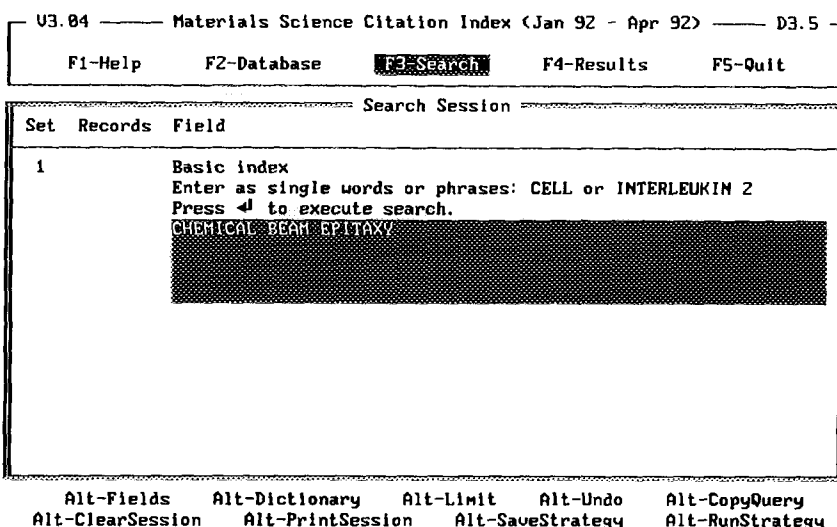


Figure 2A. The initial display screen with the keywords "chemical beam epitaxy" typed in. Press Alt and F keys simultaneously to get Fields display.

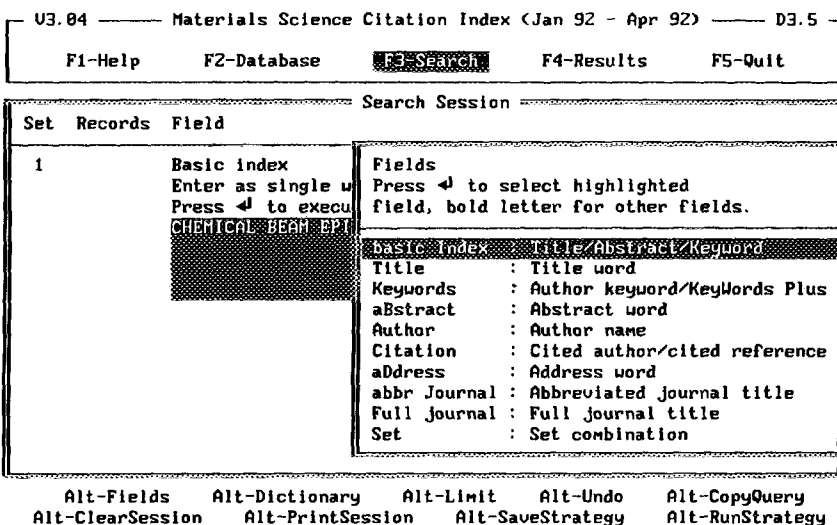


Figure 2B. Search Fields display.

searches, provide in-depth access to the literature from a number of different vantage points.

Timeliness

Timeliness has always been a hallmark of ISI service. Our integrated production system makes it possible to provide access

to the literature three months earlier than other comparable services.

Using the CD-ROM

To use the *MSCI* on CD-ROM, you must obtain a compact disk player or drive. These devices are increasingly becoming standard equipment. ISI will gladly help you in ac-

```

U3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
      F1-Help      F2-Database      F3-Search      F4-Results      F5-Quit
  
```

```

Set 1: Basic index
CHEMICAL BEAM EPITAXY
  
```

```

----- Records: 1 of 15 -----
Aspnes-DE Quinn-WE Tamargo-MC Pudensi-MAA Schuarz-SA Brasil-MJSP
Mahory-RE Gregory-S

Growth of AlxGai-xAs Parabolic Quantum-Wellls by Real-Time Feedback-
Control of Composition (English) => Article

APPLIED PHYSICS LETTERS
Vol 60 Iss 10 pp 1244-1246 1992 (HH874)

Related Records: 20      Cited References: 11

                                           <PgDn>

RelatedRecords      citedReFs      aBstract/Keywords      Addresses
  View              Collect          Print                Save
  
```

Figure 3A. Display for record containing search words "chemical beam epitaxy." When B key is pressed the following abstract appears.

```

U3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
      F1-Help      F2-Database      F3-Search      F4-Results      F5-Quit
  
```

```

S
C Abstract/Keywords      Press ESC to leave abstract/keyword display.
-----
KeyWords Plus: MOLECULAR-BEAM EPITAXY
-----
Abstract:
  Epitaxial AlxGai-xAs structures whose compositions x vary
  continuously with thickness according to a given input function have been
  grown by chemical-beam epitaxy under closed-loop ellipsometric control.
  200- and 500-angstrom parabolic quantum wells analyzed by
  photoreflectance and secondary-ion mass spectrometry, respectively, show
  that actual compositions follow target values to within 0.02 in x. Growth
  of the 200-angstrom profile was controlled using compositions
  ellipsometrically determined for the outermost running 3.1 angstrom
  (approximately 1 monolayer) of depositing material.
  
```

Figure 3B. Abstract of article by D.E. Aspnes with the words "chemical beam epitaxy."

quiring a drive should you not have one. To install the search software, simply insert the floppy disk that is supplied. It guides you in selecting the options for your hard disk and printer. In previous essays, I've not described the many print options available to you in this system, but this is indicated in Figure 1.

Once you're ready to search, the initial screen is shown (Figure 2A). At the bottom of this screen are various options. By pressing the Alt and F keys, you are shown the basic fields you can search alone or in combination (Figure 2B). However, we have selected the first example by using the "default" screen—Basic Index (high-

```

V3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
  F1-Help      F2-Database      F3-Search      R-Results      F5-Quit

Parent Record: 1 of 15
Aspnes-DE Growth of AlxGal-xAs Parabolic Quantum-Well by Real-Time Feedbac...
Related Records: 1 of 20 ----- (Level 1)

Yao-H Snyder-PG

Insitu Ellipsometric Studies of Optical and Surface-Properties of
GaAs(100) at Elevated-Temperatures (English) => Article

THIN SOLID FILMS
Vol 206 Iss 1-2 pp 283-287 1991 (G2322)

Related Records: 20   Cited References: 17   Shared References: 2
                                                                <PgDn>

RelatedRecords   citedReFs   sHaredReFs   aBstract/Keyuords   Addresses
  View           Collect      Print         Save                MakeSet

```

Figure 4A. First of 20 records related to Aspnes paper displayed in 3A. Simply press R key.

```

V3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
  F1-Help      F2-Database      F3-Search      R-Results      F5-Quit

Parent Record: 1 of 15
Aspnes-DE Growth of AlxGal-xAs Parabolic Quantum-Well by Real-Time Feedbac...
Related Records: 1 of 20 ----- (Level 1)

Yao-H Snyder-PG

Insitu Ellipson
GaAs(100) at EI

THIN SOLID FILMS
Vol 206 Iss 1-2 pp 283-287 1991 (G2322)

Related Records: 20   Cited References: 17   Shared References: 2
                                                                <PgDn>

RelatedRecords   citedReFs   sHaredReFs   aBstract/Keyuords   Addresses
  View           Collect      Print         Save                MakeSet

```

Press **↓** to search on highlighted reference.
 Press **ESC** to leave shared reference display.
 Shared References: 2

ASPNES-DE-1990-APPL-PHYS-LETT-056-P2569

STUDNA-AA-1989-J-UAC-SCI-TECHNOL-R-U7-P3291

Figure 4B. Display of 2 Shared References. Just press H key.

lighted). This search field combines in one command a search of all keyword fields, including title, author, keywords, *KeyWords Plus*, and abstracts. When you display a record, the term is highlighted wherever it occurs. Thus, in Figure 3A, the search term "chemical beam epitaxy" does not appear in the title but does appear in the abstract

(Figure 3B). Incidentally, epitaxy is from the Greek word meaning "arranging upon." The process of epitaxial growth is one of improving on the quality of crystal structure through thermal agitation of atoms.

Figure 3A shows the first record of 15 retrieved in a search of the Basic Index on "chemical beam epitaxy." Figure 3B shows

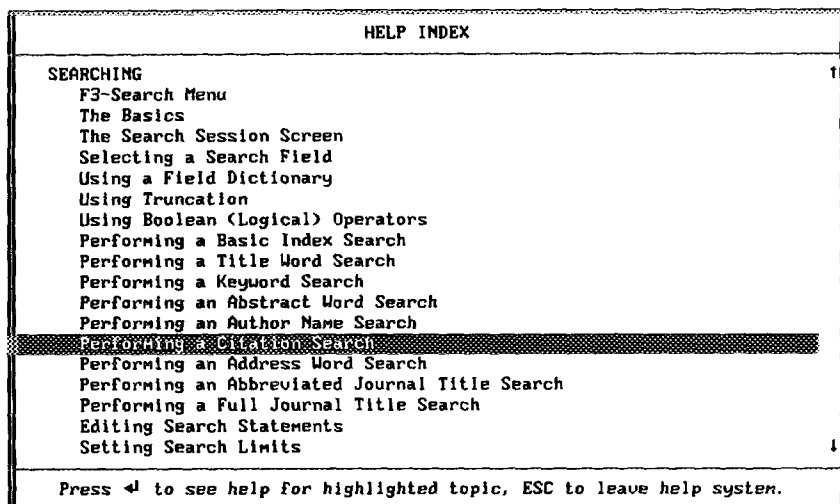


Figure 5A. Display of portion of Help Index which appears when F1 option key is pressed. "Performing a Citation Search" is highlighted.

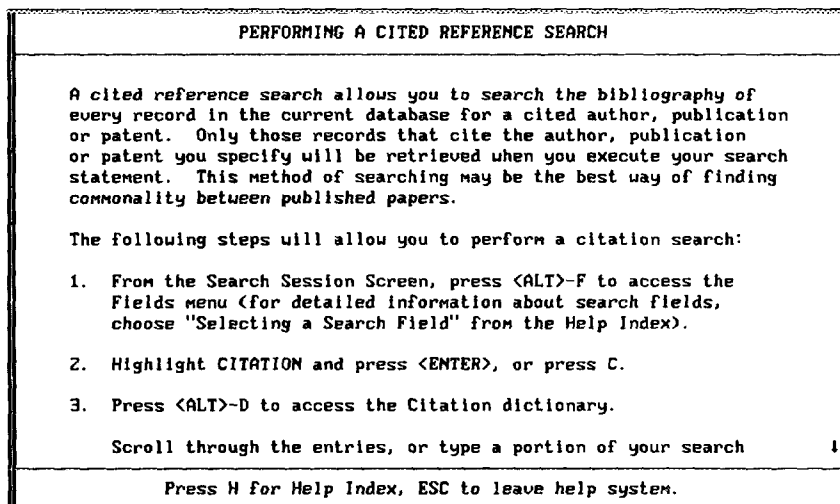


Figure 5B. When the <Return> key is pressed, text (above) appears that explains the various search options available to the researcher. The text continues when you scroll down using the arrow key.

the authors' abstract, obtained simply by pressing the B key.

No matter how you have retrieved a record, you can immediately navigate to a series of *Related Records*. These are papers that share references in common with the target paper. Figure 4A shows the first of 20 records related to the Aspnes paper in Figure 3A. The paper by Yao and Snyder

has two references in common with the paper by Aspnes. These are displayed in Figure 4B.

Comprehensive Coverage

In addition to coverage of research on the fundamental properties of materials, the *MSCI* includes references to the testing and characterization of materials, laboratory

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U3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
  F1=Help      F2=Database      F3=Search     F4=Results    F5=Quit

Search Session
Set Record
3
4
5
  Press SPACE to mark/unmark terms, ↓ to transfer term to query.
  Type letter(s) to move to another part of the dictionary.

Records Cited references
  3 TSANG-WT-1986-APPL-PHYS-LETT-U49-P220
  1 TSANG-WT-1986-APPL-PHYS-LETT-U49-P960
  1 TSANG-WT-1986-J-APPL-PHYS-U60-P418Z
  1 TSANG-WT-1986-J-ELECTRON-MATER-U15-P235
  3 TSANG-WT-1987-APPL-PHYS-LETT-U50-P1376
  3 TSANG-WT-1987-APPL-PHYS-LETT-U51-P761
  1 TSANG-WT-1987-IEEE-J-QUANTUM-ELECT-U23-P936
  1 TSANG-WT-1987-J-CRYST-GROWTH-U81-P261
  1 TSANG-WT-1987-SEMICONDUCT-SEMINET-U24-P397
  1 TSANG-WT-1987-SEMICONDUCTORS-SEMIN-U24-PCH7
  2 TSANG-WT-1989-J-CRYST-GROWTH-U95-P121
  1 TSANG-WT-1989-ULSI-ELECTRONICS-MIC-U21-P255
  1 TSANG-WT-1989-ULSI-ELECTRONICS-MIC-U21-P256
  Alt-F1
  Alt-Clear

```

Figure 6A. Citation Index Dictionary listing for TSANG-WT.

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U3.04 ----- Materials Science Citation Index (Jan 92 - Apr 92) ----- D3.5
  F1=Help      F2=Database      F3=Search     F4=Results    F5=Quit

Set 3: Citation
TSANG-WT-1986-APPL-PHYS-LETT-U49-P220
Records: 1 of 3
Feng-ZC Allerman-AA Barnes-PA Perkovitz-S
Raman-Scattering of InGaAs/InP Grown by Uniform Radial Flou Epitaxy
(English) => Article

APPLIED PHYSICS LETTERS
Vol 60 Iss 15 pp 1848-1850 1992 (HM481)

Related Records: 20   Cited References: 22

RelatedRecords      citedReFs      aBstract/Keywords      Addresses
  View              Collect        Print                Save

```

Figure 6B. Display of 1 of 3 papers turned up in cited reference search of 1986 paper by W.T. Tsang.

techniques and quality control, fabricating and finishing, structural analysis and design, etc.

The hot field of biomaterials is treated as a subset of materials science. You will find articles not only relating to the development and testing of substances used in the human body, but also to the analysis

and application of biological materials and the use of organisms in materials engineering. Coverage extends to cellulose chemistry, dental materials, and synthetic resins, among others.

Information systems designers often forget that most users are especially interested in learning the details of software and, in

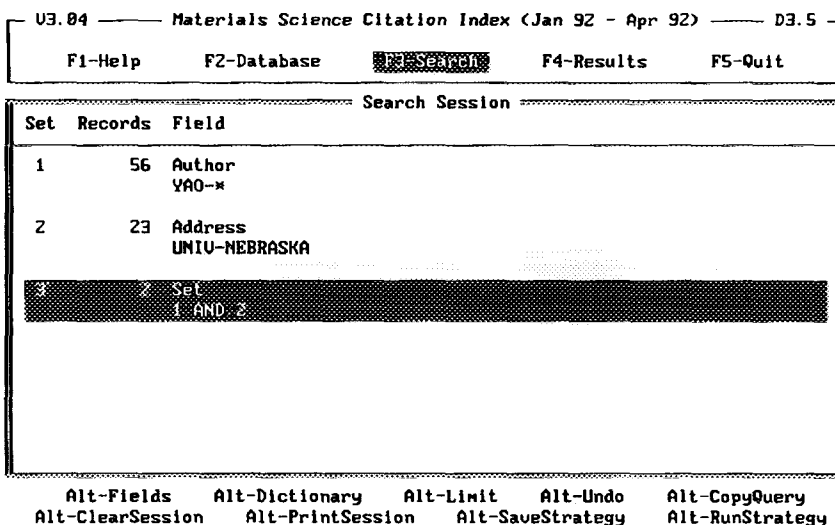


Figure 7A. Example of search for a name in combination with a university.

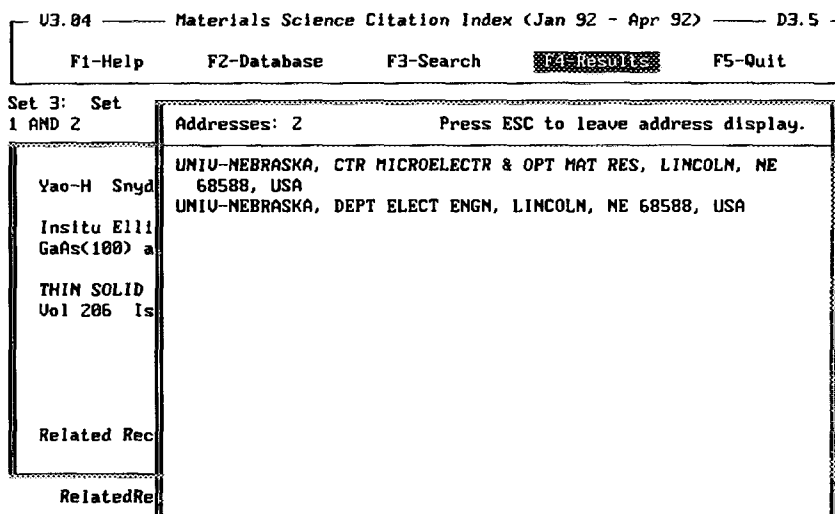


Figure 7B. Address display for H. Yao. Simply press A key.

particular, the jargon associated with it. In my personal experience with hundreds of users of ISI products, I've been able to teach the basic search functions in about 10 minutes. But, once left alone, it is important to have help instructions written in simple language. These permit you to understand the options available without consulting the manual. Figure 5A shows the Help Index. Cited reference searching is

highlighted. Figure 5B includes a portion of the help screen for cited reference searching.

Citation Searching

Unlike conventional systems, the use of our CD-ROM citation indexes allows you to search forward in time. Suppose you've encountered a paper on chemical beam epitaxial growth of semiconductor materials

reported in 1986 by W.T. Tsang and E.F. Schubert.¹⁴ You could perform a "conventional" keyword search as we did in Figures 2 and 3, but this would bring in a very large number of papers on that broad subject, whereas a citation search would be more specifically directed to the 1986 paper that has been cited in three papers during the four-month period covered in the *MSCI* from January to April, 1992.

To conduct this cited reference search, you would switch to the appropriate field (see Figure 2B) using the Alt and F keys simultaneously. Then simply type TSANG-WT and press the ↵ return key. You get the dictionary listing shown in Figure 6A. This shows each of Tsang's papers cited in 1992. The 1986 paper in question has been cited three times. Figure 6B shows the record for one of these papers.

The search fields for authors and addresses can be used for a variety of purposes. One common search is illustrated in Figure 7A. Suppose you've heard about a

paper by Yao at the University of Nebraska, but you don't remember his or her initials. So you first create a set consisting of all 56 papers by different authors named Yao. Then you create another set of papers for UNIV-NEBRASKA. Using the set command, you find two papers, one of which is shown in Figure 4A discussed above. Figure 7B shows the address display for that record.

The *MSCI*, presently only available for IBM compatible PCs and NEC systems, sells for \$1,950 a year. A multiple copy rate is available. For a free trial subscription, write Institute for Scientific Information, 3501 Market Street, Philadelphia, PA 19104. Or call 1-800-336-4474, or (215) 386-0100, ext. 1483. In Europe, Africa, and the Middle East call +44-895-270016.

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REFERENCES

1. Garfield E. The new *Biomedical Engineering Citation Index* database on CD-ROM, containing searchable abstracts, *Related Records*, and *KeyWords Plus*. *Current Contents* (29):3-10, 20 July 1992.
- 2.----- The new *Biotechnology and Neuroscience Citation Indexes* on CD-ROM include abstracts and increased coverage. *Current Contents* (1):3-8, 6 January 1992.
- 3.----- *New Chemistry Citation Index* on CD-ROM comes with abstracts, *Related Records*, and *KeyWords Plus*. *Current Contents* (3):5-9, 20 January 1992.
4. Slichter W P. Chemical research in materials science. (Good M L, ed.) *Biotechnology and materials science*. Washington, DC: American Chemical Society, 1988. p. 63-9.
5. Bever M B, ed. *Encyclopedia of materials science and engineering*. Cambridge, MA: MIT Press, 1986. 8 vols.
6. Peterson I. Glass fibers to channel neutrons to a focus. *Science News* 141(23):373, 1992.
7. Mitchell P J & Wilcox G D. An electrochemical route to pre-shaped ceramic bodies. *Nature* 357(6377):395-7, 1992.
8. Garfield E. The 1987 Nobel Prize in physics: citations to K.A. Müller and J.G. Bednorz's seminal work mirror developments in superconductivity. *Current Contents* (18):3-11, 2 May 1988. (Reprinted in: *Essays of an information scientist: science literacy, policy, evaluation, and other essays*. Philadelphia: ISI Press, 1990. Vol. 11. p. 129-37.)
9. Paradowski R J. Karl Alexander Müller and J. Georg Bednorz. (Magill F N, ed.) *The Nobel Prize winners: physics. Volume 3. 1968-1988*. Pasadena, CA: Salem Press, 1989. p. 1333-48.
10. Anderson J C, Leaver K D, Rawlings R D & Alexander J M. *Materials science*. London: Chapman & Hall, 1990. 608 p.
11. Garfield E. *KeyWords Plus*: ISI's breakthrough retrieval method. Part 1. Expanding your searching power on *Current Contents on Diskette*. *Current Contents* (32):5-9, 6 August 1990. (Reprinted in: *Op. cit.*, 1991. Vol. 13. p. 295-9.)
- 12.----- *KeyWords Plus* takes you beyond title words. Part 2. Expanded journal coverage for *Current Contents on Diskette* includes social and behavioral sciences. *Current Contents* (33):5-9, 13 August 1990. (Reprinted in: *Ibid.* p. 300-4.)
- 13.----- Announcing the *SCI Compact Disc Edition*: CD-ROM gigabyte storage technology, novel software, and bibliographic coupling make desktop research and discovery a reality. *Current Contents* (22):3-13, 30 May 1988. (Reprinted in: *Ibid.*, 1990. Vol. 11. p. 160-70.)
14. Tsang W T & Schubert E F. Extremely high quality Ga_{0.47}In_{0.53}As/InP quantum wells grown by chemical beam epitaxy. *Appl. Phys. Lett.* 49:220-2, 1986.