

SpringerMaterials

The fast and accurate discovery tool
for researchers at every level

White
Paper





With SpringerMaterials researchers can cut through extraneous information and get straight to the trusted resources they need

Introduction

A steady rise in the number of published papers, and increased access to data from institutions across the world, means that researchers have access to more content on their subject than ever before. But they are discovering that to be useful, this information must be effectively managed. One issue is that there may be a lot of high quality data or analysis that, while it is in the general area of a field of study, is not directly relevant to a particular research project. Whilst access to a huge amount of research data is undoubtedly a good thing, researchers need to be able to find the content that will be most useful to them.

For researchers at every level, from undergraduates to professionals, this means verified, peer reviewed information from trusted sources that can be examined over and over again. Finding the most relevant data from the most appropriate sources can be a particular issue for undergraduates, who are more likely to use general search engines that won't always take them to content which meets the requirements of scientific study.

As data sets become larger, and more diverse, researchers also need access to specialist tools with which to interrogate them. In a specialist area like materials science, keyword searching, whilst still a useful starting point, is not always enough.

This white paper will show how subject specific databases such as SpringerMaterials can help researchers find their way through an abundance of data by providing well designed, tailored tools.

Inside SpringerMaterials

SpringerMaterials is the largest resource for properties, figures and graphs in materials science, with over 500,000 online documents covering 3,000 properties across 250,000 materials and chemical systems.

A unique and authoritative data collection on chemical and physical materials, the database is principally based on the **Landolt-Börnstein Series**; critically reviewed physical & chemical data for numerous areas of materials science research. It also contains a number of other collections:

- **MSI Database:** Critically evaluated phase diagrams reports of binary and ternary metal systems.
- **Linus Pauling Files:** Structural data, phase diagram and physical properties of inorganic solid phase materials.
- **Advanced Thermal Analysis System:** Thermodynamic properties of polymers.
- **Dortmund Databank Separation Technology:** Thermophysical properties of organic single components and binary mixtures.
- **Adsorption Isotherm Database:** Gas adsorption data for various gases and adsorbents.
- **Corrosion Database:** Corrosion rate data for metals and alloys also covering exposure conditions and environment.

SpringerMaterials is fast. The periodic table search provides intuitive, specific data, it's totally different from a conventional data search engine. The colorful 3-D crystal structure view not only provides direct knowledge on the bond length, bond angle, etc. but also leaves a very strong visual impression.

Prof. Jun Jiang, Chemical Physics
University of Science and Technology
of China

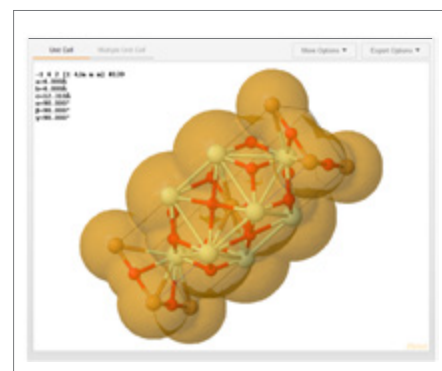
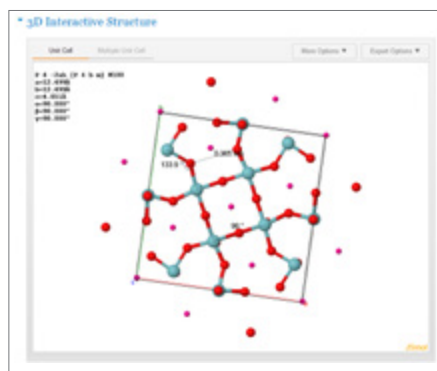
Findability & search speed

There are several reasons why researchers can find data much faster with a dedicated database instead of generic search engines. One major reason is that general search engine indexing logic is not optimized for materials science and related subjects.

SpringerMaterials allows for all the usual content navigation; users can browse the different collections, filtering the content by data source, discipline and properties, and use the bookshelf feature to navigate easily through book collections. Researchers looking for specific information on a specific material or property can search by the simple text box, the search by element or search by structure.

These subject specific search tools are used by researchers to reduce the time needed to find exact, relevant information.

Interactive functionality saves researcher's time and provides deep insights into content



3D interactive crystal structures

View crystal structures from published data and create your own personalized view. Measure angles and distances, display multiple unit cells, and easily export the customized image

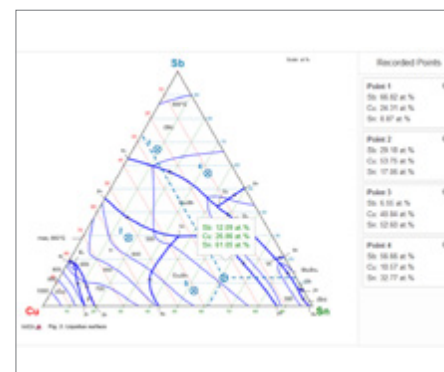
Heat of Vaporization of Benzene

Temperature (°C): [200 to 300] Pressure (kPa): [101.325 to 101.325]

Temperature (°C)	Pressure (kPa)	Heat of Vaporization (kJ/mol)	State	Reference
200.00	101.3	2988.00	Vapor-Liquid	[7, Fock (1957)]
200.00	101.3	2981.00	Vapor-Liquid	[8, Thibaut (1962)]
200.00	101.3	2981.00	Vapor-Liquid	[7, Fock (1957)]
200.00	101.3	2981.00	Vapor-Liquid	[8, Thibaut (1962)]
200.00	101.3	2981.00	Vapor-Liquid	[8, Thibaut (1962)]
200.00	101.3	2981.00	Vapor-Liquid	[7, Fock (1957)]
200.00	101.3	2981.00	Vapor-Liquid	[8, Thibaut (1962)]
200.00	101.3	2981.00	Vapor-Liquid	[8, Thibaut (1962)]

Manipulate data with sliders

Easily sort through large datasets by selecting specific data ranges



Exact data points with interactive phase diagrams

Over 40,000 interactive phase diagrams include tools to determine phase transitions and record points of interest



Corrosion search

Search by material, environment or both, sorting by corrosion rating. Access and download detailed information on exposure conditions



Citation exporter

Citations for SpringerMaterials content can be easily exported in multiple standard formats

Search times using SpringerMaterials and search on the open web – a comparison

SpringerMaterials section the result is located in	Search query	Time taken for user to reach relevant information on	
		SpringerMaterials	The Open Web
Thermophysical Properties	Dielectric constant of toluene and butan-1-ol mixture	20 seconds	20 seconds <i>Web search returned SpringerMaterials the first several search results</i>
Adsorption Database	Adsorption isotherm for methane on CMS1	10 seconds	Search abandoned after 5 minutes , many irrelevant results
Polymer Thermodynamics	Enthalpy of polystyrene	10 seconds	Over 5 minutes <i>Needed to click through to several different results to eventually locate the data</i>
Landolt-Börnstein	Bi ₂ O ₃ heat capacity	10 seconds	1 minute <i>First results were from Landolt-Börnstein, SpringerLink, or other sources</i>
Landolt-Börnstein	Polystyrene compressibility	30 seconds	2 minutes <i>Page 1 of web results linked to book content that showed plots but no data Page 3 of results linked to another book that did show experimental, numerical values</i>
MSI Database	In-Ga-As ternary phase diagram	10 seconds 2 of 7 results from Landolt-Börnstein, others from MSI Database	4 minutes <i>Page 3 of web results provided a link to a phase diagram search, however, these were dead links</i>
Inorganic Solid Phases	Nb-W Young's modulus	5 seconds	Search abandoned after 5 minutes . <i>Data not found, irrelevant results or results for closely related systems</i>



We expect authors to be expert and careful in presenting data.

Prof. Bharat Bushan,
Mechanical & Aerospace Engineering,
Ohio State University

A useful database should be convenient for its users, the data should be very accurate and reliable, and the results found through a search should be of high relevance. In my opinion, SpringerMaterials is doing very well in all those three aspects.

Dr. Yafong Fan, Science Librarian
University of Science and Technology
of China

Creating a trusted resource – the work of Springer Nature editors

Not only is a database like SpringerMaterials faster for students and researchers, the information they are looking at is accurate and trusted. Thousands of editors and contributors work to ensure the quality of the database.

Where books have multiple authors, the authors will review other chapters of the book in the first instance. After this initial screening process, where anomalies can be picked up, the editor will read both the reviews and the chapter. After this reading, a final report is created, synthesizing the views of everyone who has reviewed the work. The author will be asked to make revisions, and will get a chance to clarify any points that aren't clear.

Having multiple reviewers for a chapter pushes up the quality of the research, not just in terms of the accuracy of the data, but in how it is presented and explained to the reader.

Springer experts, all of whom have a PhD level qualification in the fields of chemistry, physics, or materials science, carefully review all the individual pieces of data added to SpringerMaterials. Materials science is an area where experimental accuracy is of particular importance, especially when data is relied upon to create models from which new discoveries will arise. Springer experts all come from a research background, and take their responsibility for accuracy extremely seriously.

For example, in the Adsorption Isotherm Database in SpringerMaterials, data for industrially relevant solids and gases is compiled from current literature. This does not include data for new or emerging materials which are not well characterized and synthesized only in small quantities; all the materials included are well-known with proven synthesis routes. Conflicting data in adsorption isotherms is very common, since small changes in handling, activation, and procedures can make a difference to the way they behave, so the data in SpringerMaterials is screened for best practice.

For accuracy, the team also focus on the availability of numerical data rather than less reliable graphical data. With graphs, Springer editors contact the authors and request tabulated data for evaluation.

SpringerMaterials in practice

Use case: enhancing the data search

Dr. Yafong Fan, Science Librarian at the University of Science and Technology of China, explains one way SpringerMaterials supports her work.

“One of the students was exploring TiO₂ flexible dye-sensitized solar cells, in particular, its electron transport properties. The student came for a tutorial at the beginning of the research project. They were at a loss, having searched for information on major search engines, which yielded millions of results. None provided the information they needed to start the project. They also tried several major specialized databases but again didn't find the information they needed. What made the difference was a simple search on SpringerMaterials. We typed the term “titanium dioxide” along with “transport properties” in the search box. The number of results was far less than using a general search engine. Crucially, the results gave the student the information they had been looking for. In fact, almost every result from this one search was relevant to the project. The student went away able to begin work, when before they hit a dead end.”



Sometimes I suddenly have a research idea but I am not next to my computer. I can use my mobile phone to search for data or to verify my concept. It's a great privilege to carry the databases with me at all times.

Mobile device capability is incredibly beneficial to both undergraduate and graduate students. They can cultivate a good habit of using database every day.

Prof. Jun Jiang, Chemical Physics
University of Science and Technology of China

Use case: supporting materials design

Prof. Jiang Jun, of the University of Science and Technology of China, describes an example of SpringerMaterials being used in his research group's catalysis projects.

"Recently we have been using SpringerMaterials for collecting data on energy band gaps of different materials, which are very helpful in the design of catalysts. In one case, researchers took the crystallographic data in SpringerMaterials, and created many different models to investigate how the different crystal planes of different metals interact with the crystal plane of Cu₂O. The models, based on trusted data, allowed the team to work faster, and at the end were experimentally verified. SpringerMaterials thus provided significant guidance, allowing the research project to reach a successful conclusion."

Summary

Case studies and user feedback on SpringerMaterials reaffirm the value of content from publishers rather than that from the open web. Researchers need to trust the content they are reading, and well established content curation procedures mean they can rely on the data in SpringerMaterials. When they need fast access to the most relevant information for a particular project, the database allows them to cut through the 'noise' of research that is itself high quality, but simply not relevant to the project at hand. They need to interrogate the database in subject specific ways, and **search by element** or **search by structure** are tools that are designed specifically for this field of study.

Ultimately, specialist resources need specialist search and delivery tools. SpringerMaterials provides this specialist approach for materials scientists, creating a valuable resource that is fundamentally different, but highly complementary to traditional resources like books and journals. Indeed, this new way of searching for and presenting information can create the opportunity for new research to take place.



SpringerMaterials enhances research and development

