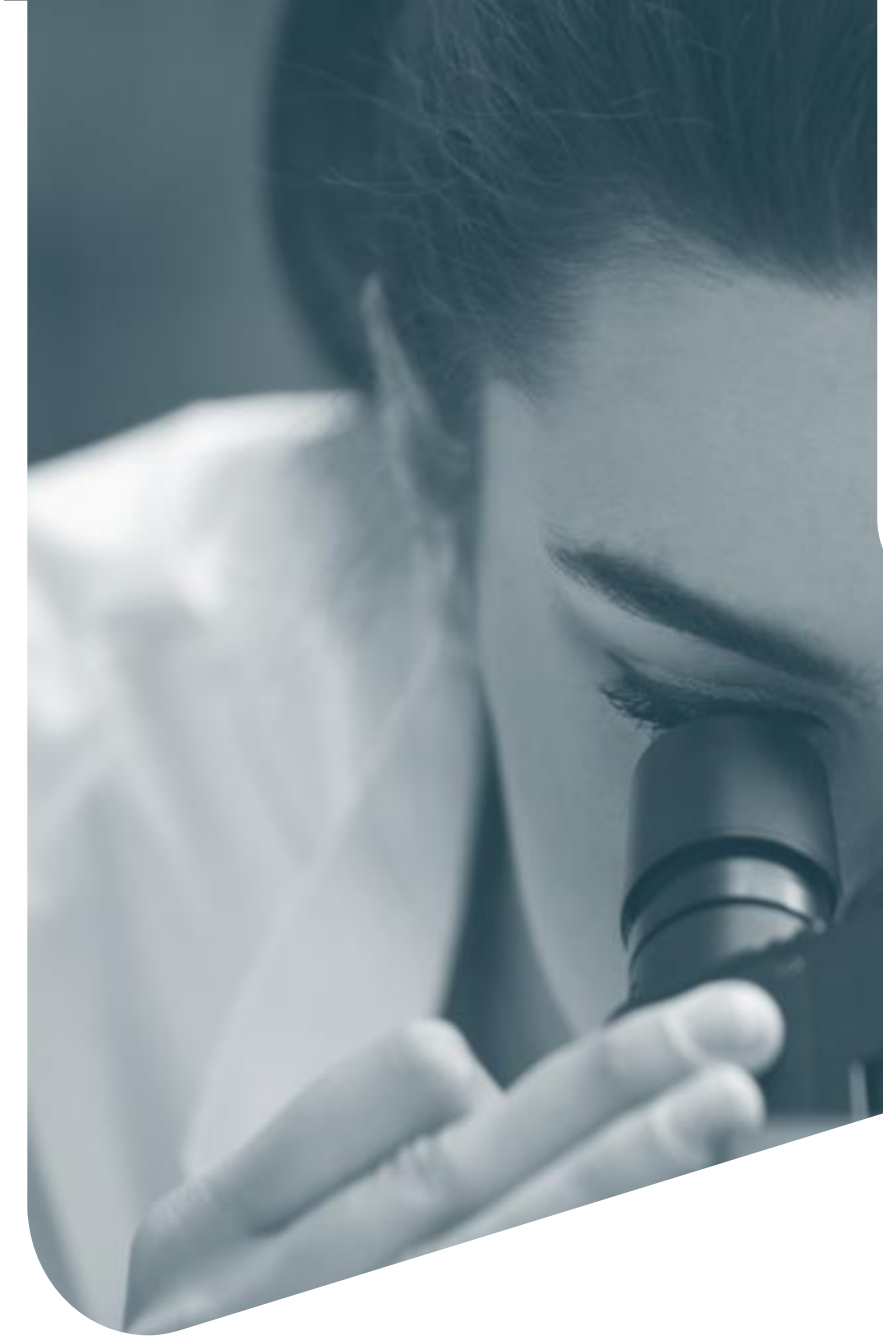


SpringerMaterials 如何帮助您进行材料科学与工程的研究和数据检索

演讲人：肖娟秀 （Ph.D）
产品经理

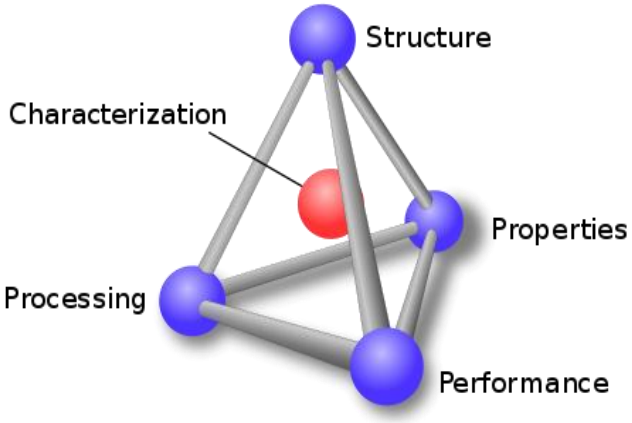
SPRINGER NATURE

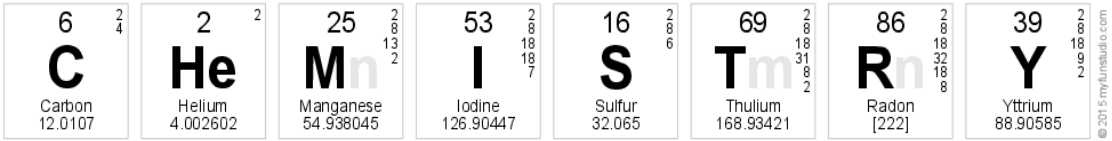
今天提纲:

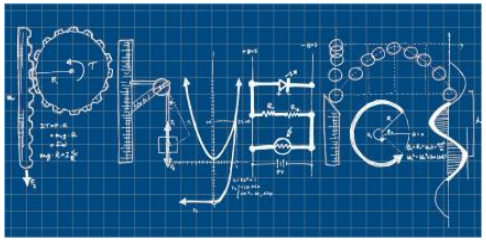
1. 背景介绍
2. SpringerMaterials简介
3. Landolt Bornstein 和其他模块介绍
4. 案例研究
5. 问题解答

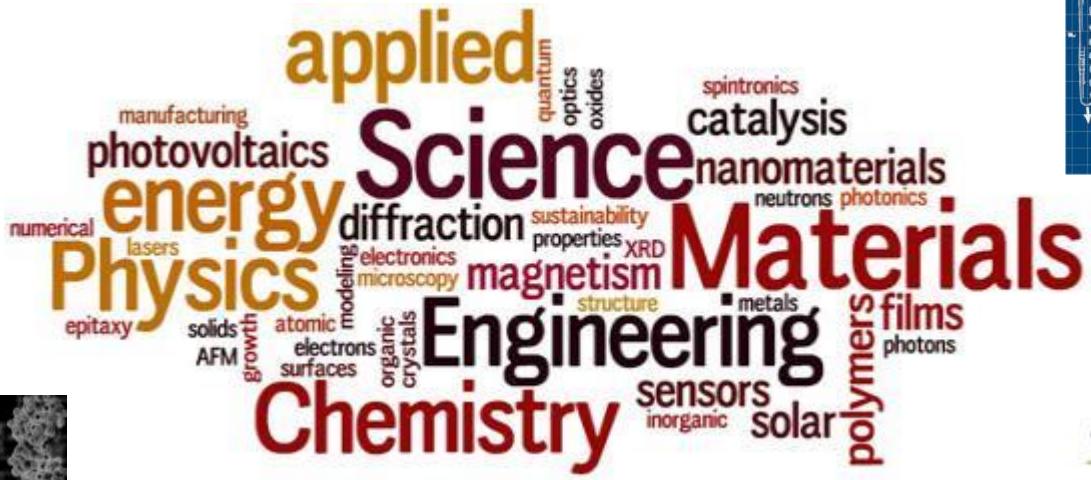
什么是材料科学?

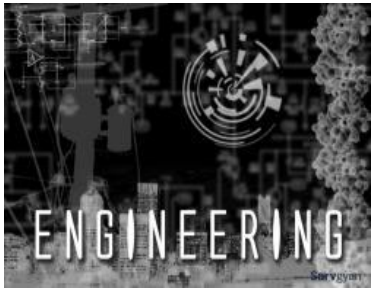
- Materials science is the “study of stuff”[1,2]
- Find & use relations between the structure and properties of materials
- Materials science is **multidisciplinary**:[3]











SPRINGER NATURE

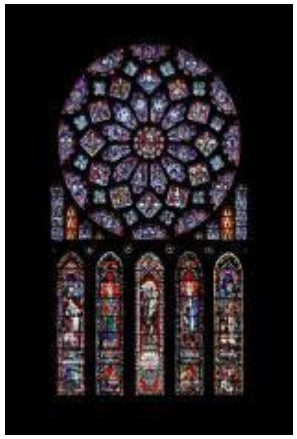
1) strangematterexhibit.com/whatis.html
2) en.wikipedia.org/wiki/Materials_science
3) rit.edu/cos/cmse/

材料种类

Metals

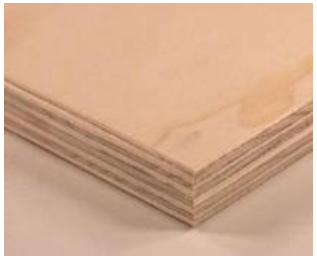
Ceramics

Polymers

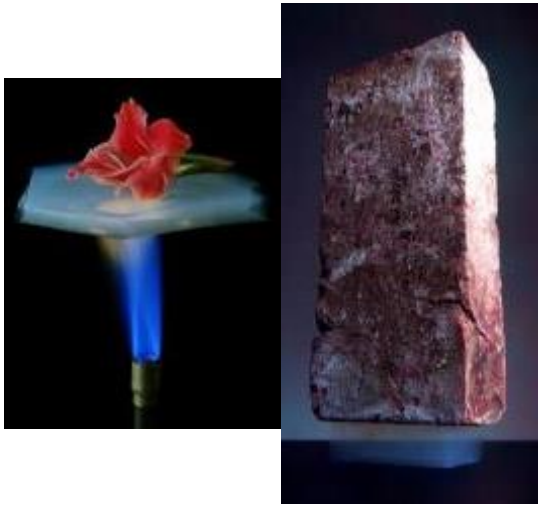


Glass

Electronic Materials



Composites



Exotic Materials

Minerals

Biomaterials

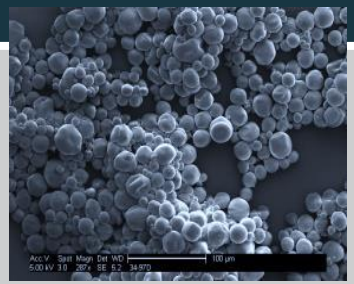
SPRINGER NATURE

材料科学涉及的领域

Semiconductors & Electronics

Chemical Engineering & Manufacturing

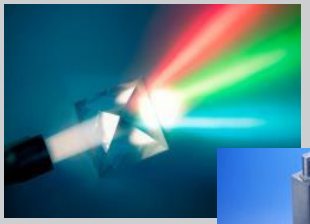
Chemical Processing & Analysis



Engineering (Automotive, Aerospace)

Fuels & Energy

Glasses & Ceramics

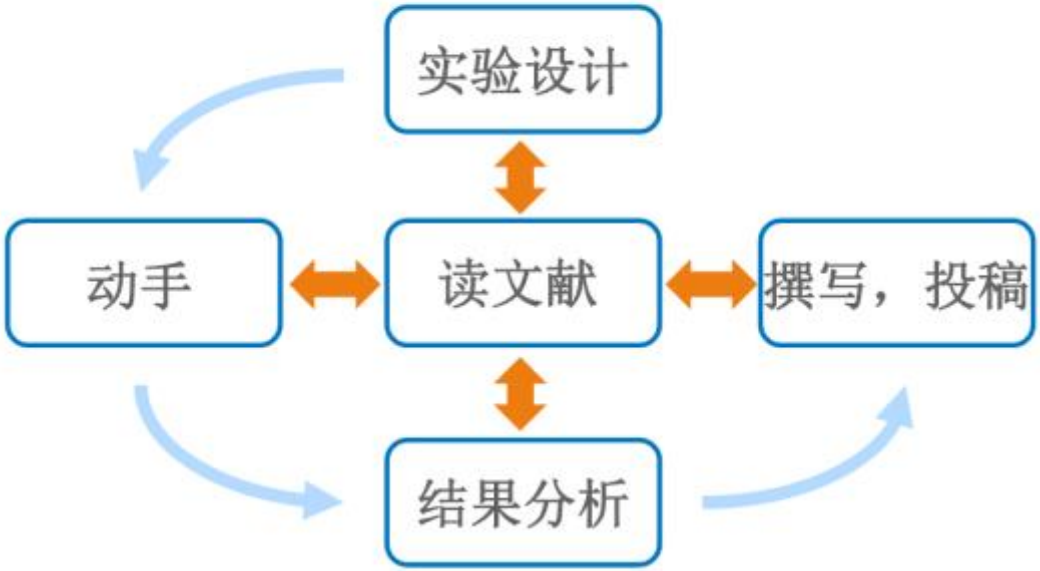


Metals & Mining

Polymer Science

什么是材料科学研究？

- 每日必修内容---读文献！！！



为什么要读文献？
1. 知己知彼
2. 建立科学问题
3. 设计实验

- SpringerMaterials大大降低询查和核对资料与数据的时间！！！

SpringerMaterials是什么?

SpringerMaterials：*经筛选整理的**材料性质**数据库*

主要材料类型与性质分类包括

- 金属与合金
- 陶瓷与玻璃
- 高分子聚合物
- 有机物
- 复合材料
- 原子与原子核

- 物理
- 化学
- 热力学
- 电磁学
- 结构
- 机械
- 光谱学
- 原子能

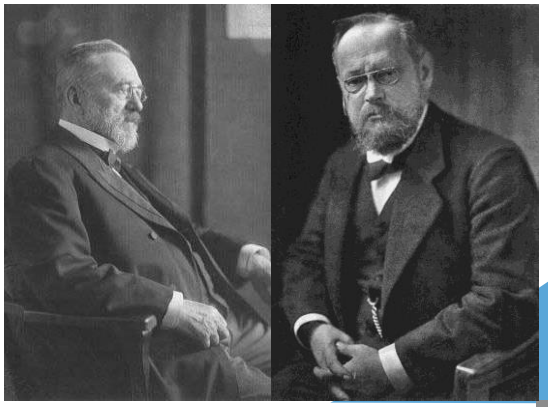
SpringerMaterials与Landolt-Börnstein: 历史回望

LANDOLT-BÖRNSTEIN

实验结果综述，最佳实验做法，等等

由超过1000名专家、学者、编辑评审的数据

柏林
1883



Hans Landolt

Richard Börnstein

The Landolt-Börnstein Series

Landolt-Börnstein：*威名显赫的用户*

ANNALEN

DER

PHYSIK.

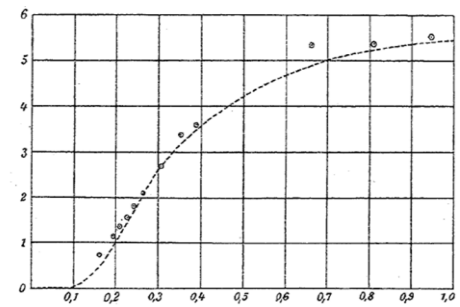
9. ***Die Plancksche Theorie der Strahlung und die Theorie der spezifischen Wärme;***
von A. Einstein.

In zwei früheren Arbeiten[1]) habe ich gezeigt, daß die Interpretation des Energieverteilungsgesetzes der schwarzen Strahlung im Sinne der Boltzmannschen Theorie des zweiten Hauptsatzes uns zu einer neuen Auffassung der Phänomene der Lichtemission und Lichtabsorption führt, die zwar noch keineswegs den Charakter einer vollständigen Theorie besitzt, die aber insofern bemerkenswert ist, als sie das Verständnis einer Reihe von Gesetzmäßigkeiten erleichtert. In der vorliegenden Arbeit soll nun dargetan werden, daß die Theorie der Strahlung — und zwar speziell die Plancksche Theorie — zu einer Modifikation der molekular-kinetischen Theorie der Wärme führt, durch welche einige Schwierigkeiten beseitigt werden, die bisher der Durchführung jener Theorie im Wege standen. Auch wird sich ein gewisser Zusammenhang zwischen dem thermischen und optischen Verhalten fester Körper ergeben.

Bern, November 1906.

(Eingegangen 9. November 1906.)

190 *A. Einstein. Plancksche Theorie der Strahlung etc.*



betreffenden festen Stoffe vorkommen, für die spezifische Wärme pro Grammäquivalent den Ausdruck[1])

$$c = 5{,}94 \sum \frac{e^{\frac{\beta\nu}{T}} \left(\frac{\beta\nu}{T}\right)^2}{\left(e^{\frac{\beta\nu}{T}} - 1\right)^2}. \tag{8a}$$

Wir entnehmen ferner den Tabellen von Landolt und Börnstein einige Angaben über ultrarote Eigenschwingungen (metallische Reflexion, Reststrahlen) einiger durchsichtiger fester Körper; die beobachteten λ sind in nachstehender Tabelle unter „$\lambda_{beob.}$" angegeben; die Zahlen unter „$\lambda_{ber.}$" sind obiger Tabelle entnommen, soweit sie sich auf Atome von abnorm kleiner spezifischer Wärme beziehen; für die übrigen soll $\lambda > 48\,\mu$ sein.

Körper	$\lambda_{beob.}$	$\lambda_{ber.}$
CaFl	24; 31,6	33; > 48
NaCl	51,2	> 48
KCl	61,2	> 48
$CaCO_3$	6,7; 11,4; 29,4	12; 21; > 48
SiO_2	8,5; 9,0; 20,7	20; 21

SPRINGER NATURE

SpringerMaterials: 内容总览

7个数据库，530,000+ 文档, 290,000+ 材料, 32,000 物性档 以及更多正在更新的内容

LANDOLT-BÖRNSTEIN

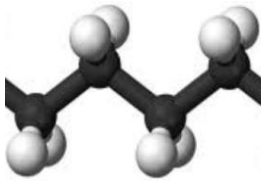
专家撰写综述及众多物性档案

MSI Science Simplified

专家撰写的报告以及互动相图

Linus Pauling

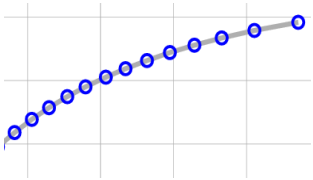
Inorganic Solid Phases
1.相图
2.化学及物理物性
3.晶体结构及数据



Advanced Thermal Analysis System (ATHAS) – 高分子的热物性数据

DDBST

Dortmund Data Bank Software & Separation Technology – 有机物质的热物性数据



等温吸附曲线数据库

腐蚀数据库

SpringerMaterials: 内容总览

1 Landolt-Börnstein

2 MSI Eureka

3 Inorganic Solid Phases

4 Polymer Thermodynamics

5 Thermophysical Properties

6 Adsorption

7 Substance Profile

N Landolt-Börnstein bookshelf

SpringerMaterials Interactive

7个数据库，530,000+ 文档, 290,000+ 材料, 32,000 物性档 以及更多正在更新的内容

SPRINGER NATURE

关键材料科学主题涵盖

材料结构
- *相图*
- *晶体数据*

理化数据
- *电子、光学、磁学性质*
- *机械性质、反应等*

热力学
- *相平衡于转换*
- *混合物性质*

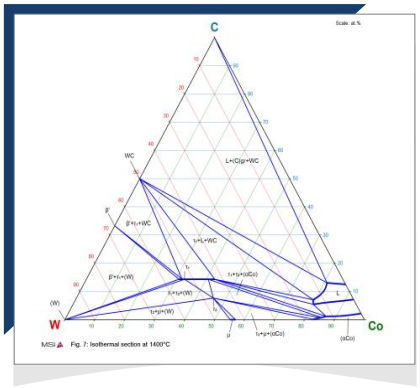
材料分析
- *光谱*
- *显微成像*
- *表征*

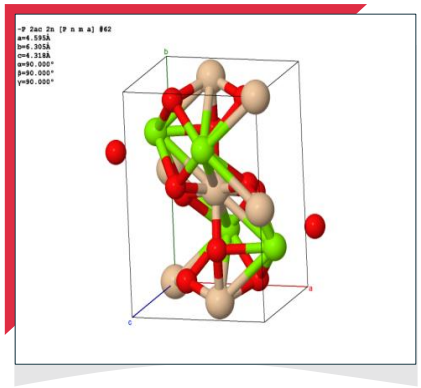
表面科学
- *气体扩散*
- *金属腐蚀*
- *扩散*

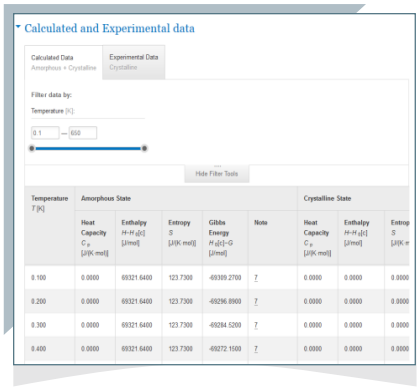
SPRINGER NATURE

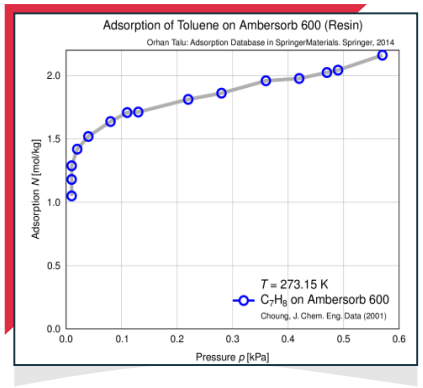
SpringerMaterials内容概览

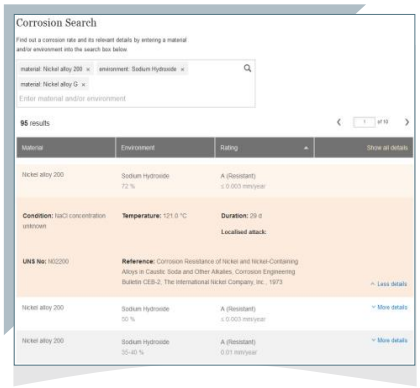
数据类型：*相图、晶体结构、数据表格、材料性质档案 、曲线图等等。*

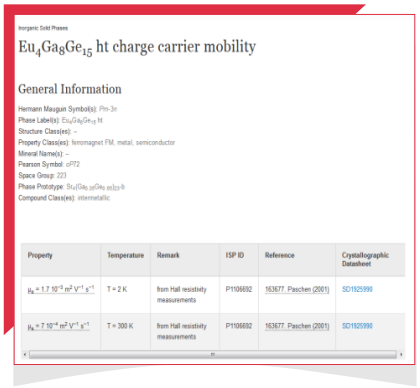


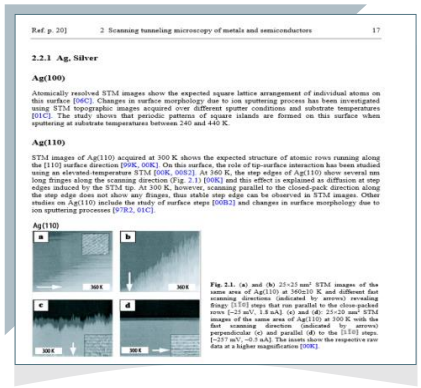








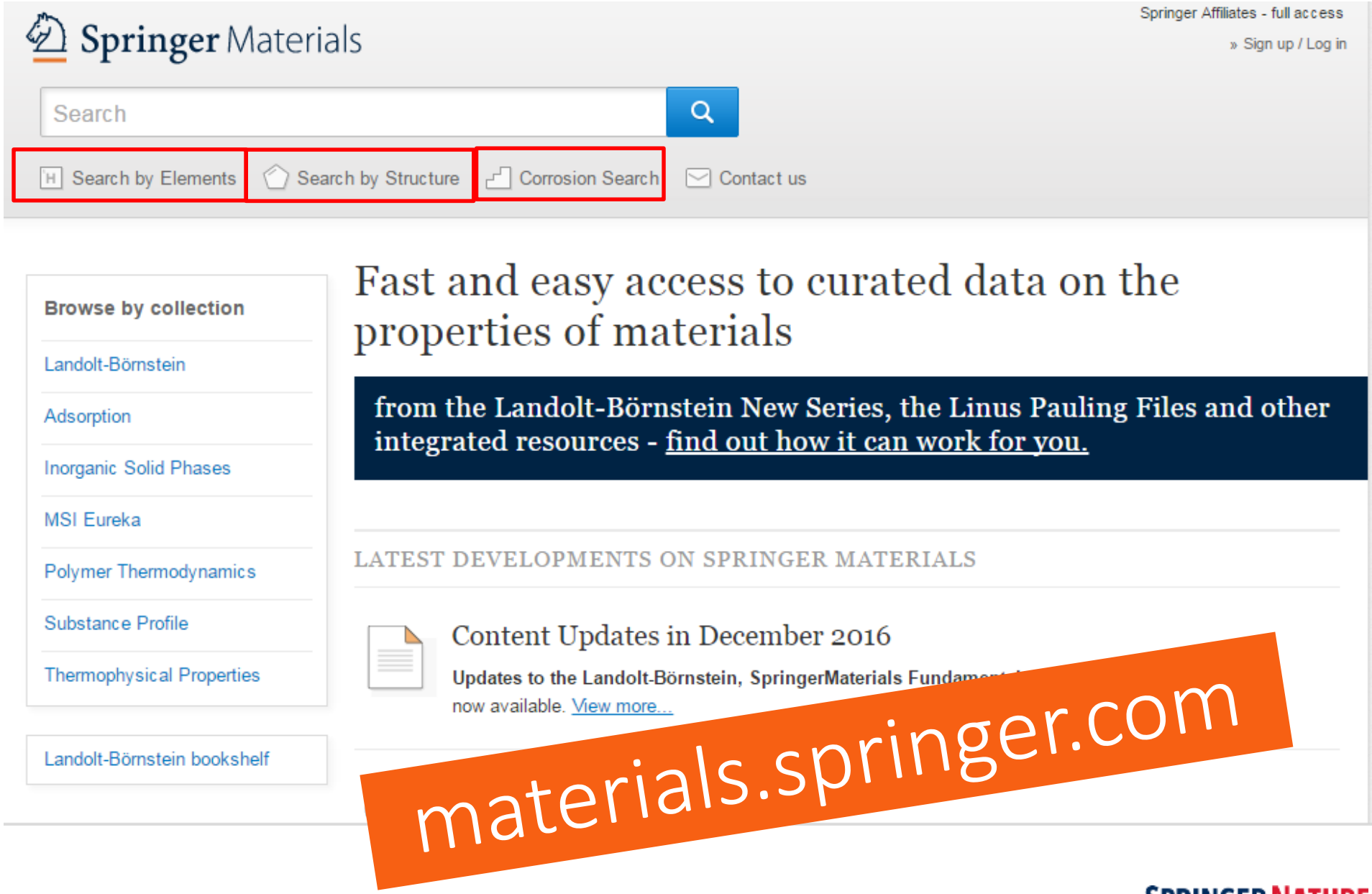




数据库内容按季度更新

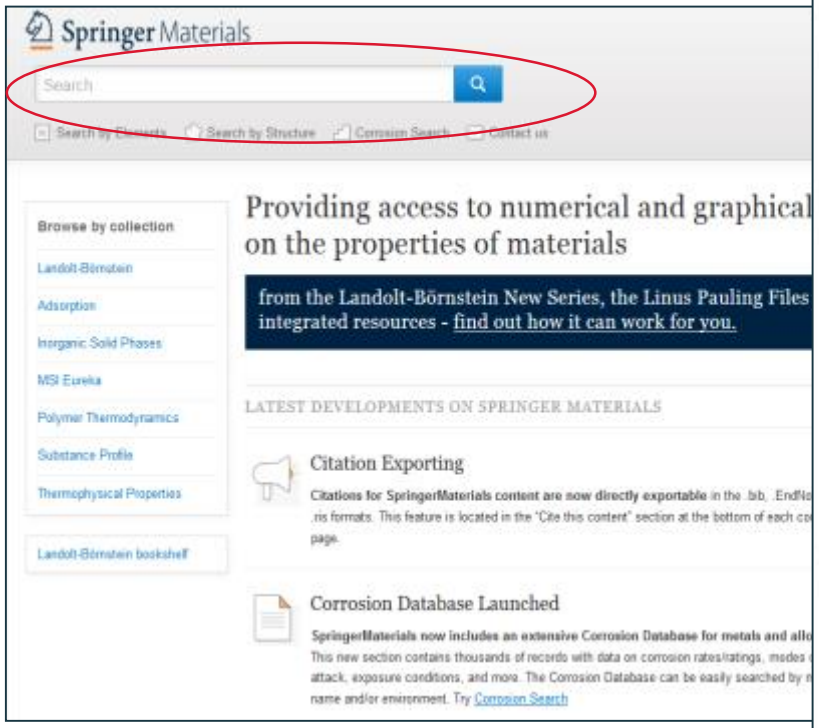
SPRINGER NATURE

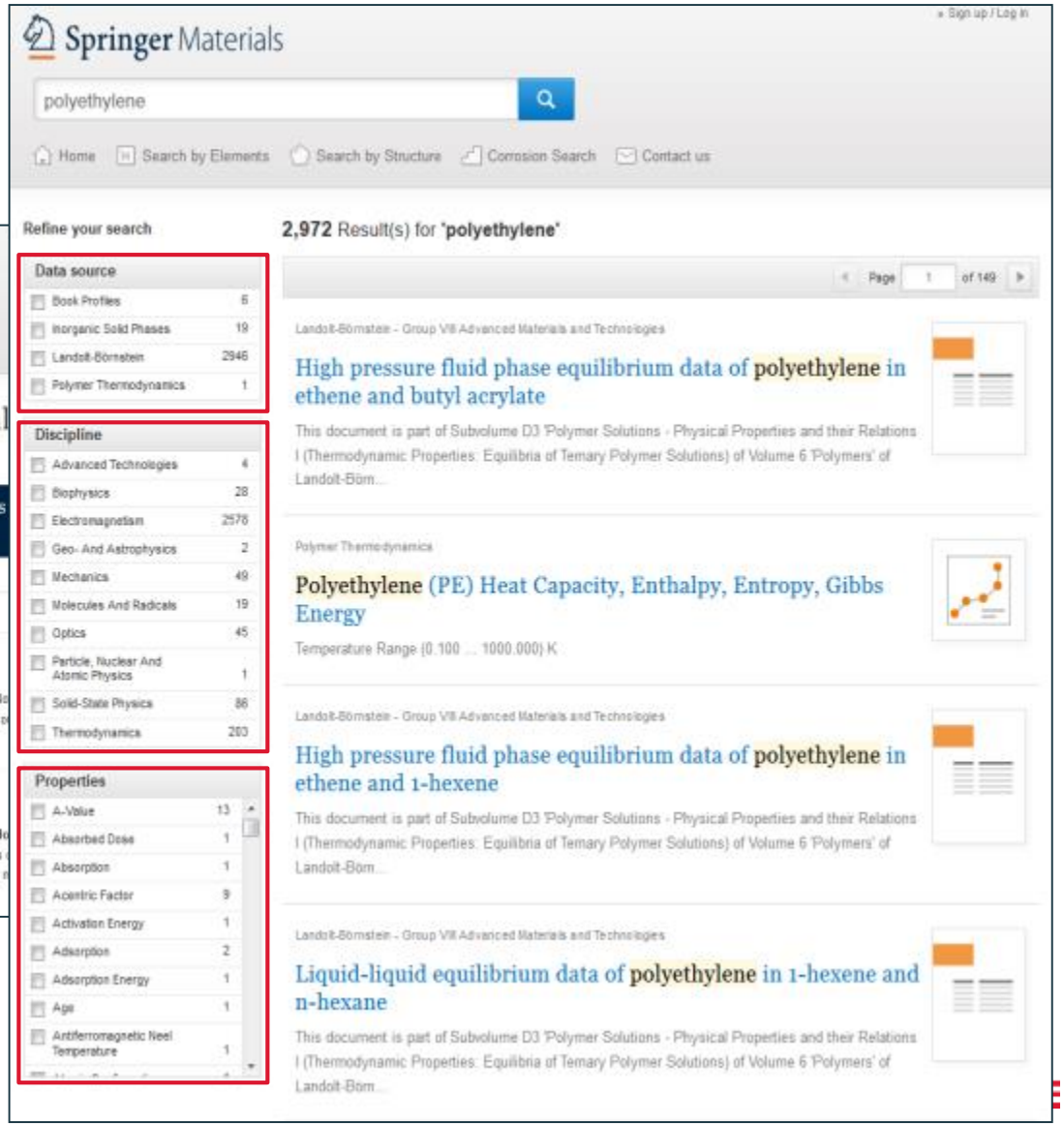
SpringerMaterials平台



Text Search and Result Refinement

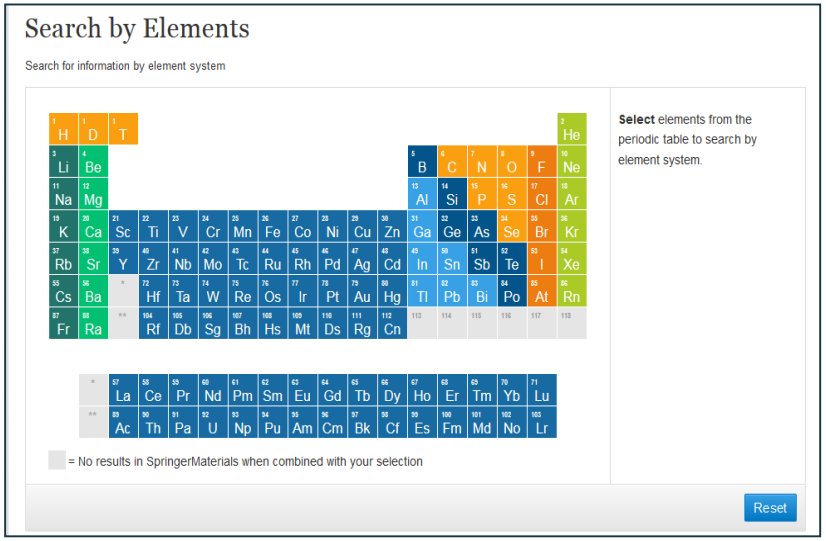
- Results can be refined according to data source, discipline, and/or individual material property:

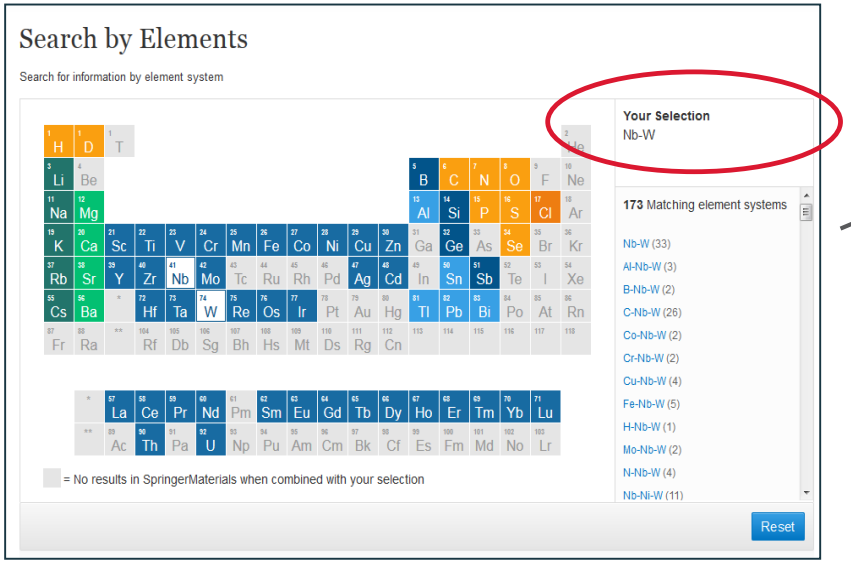


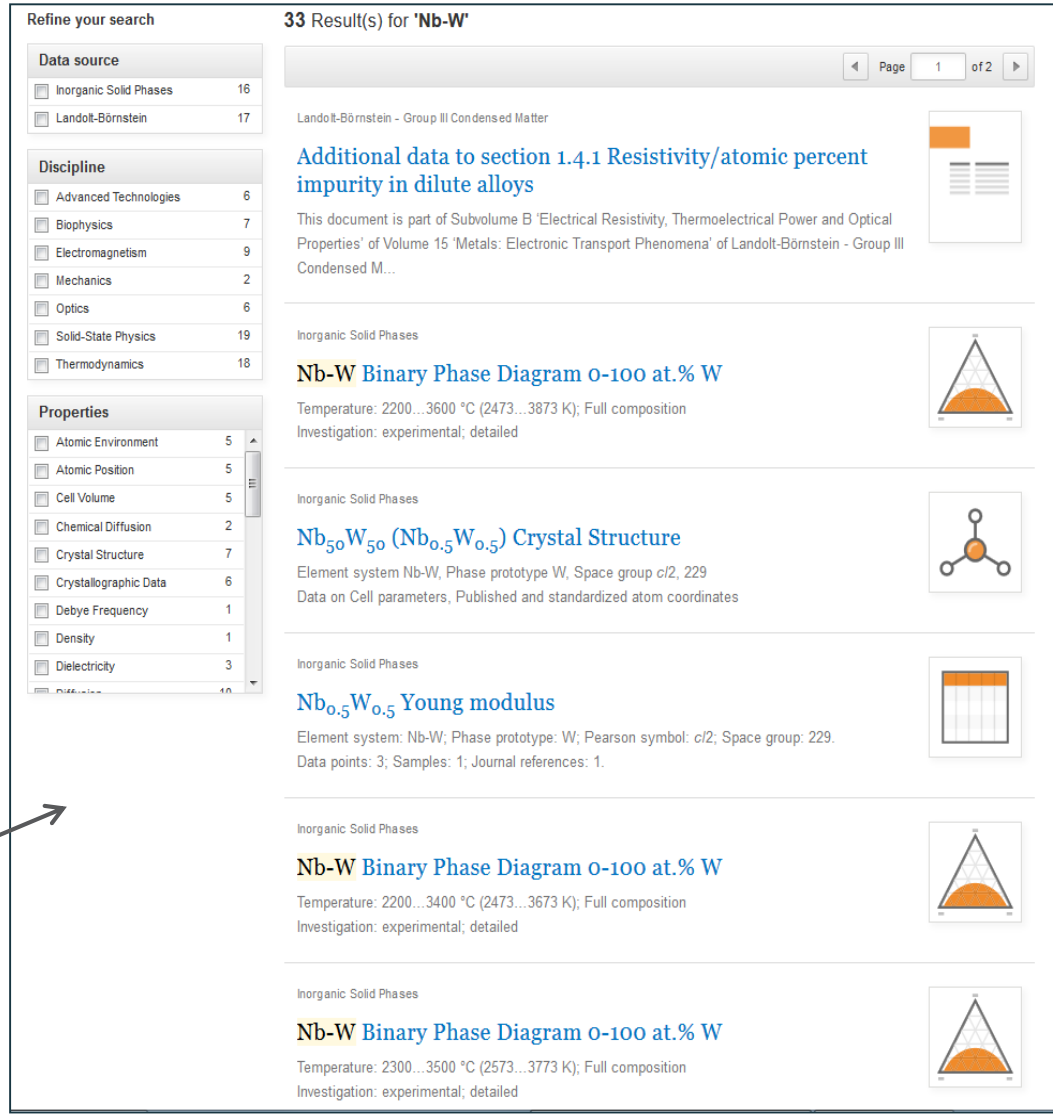


Periodic Table Search

- Query: Nb-W

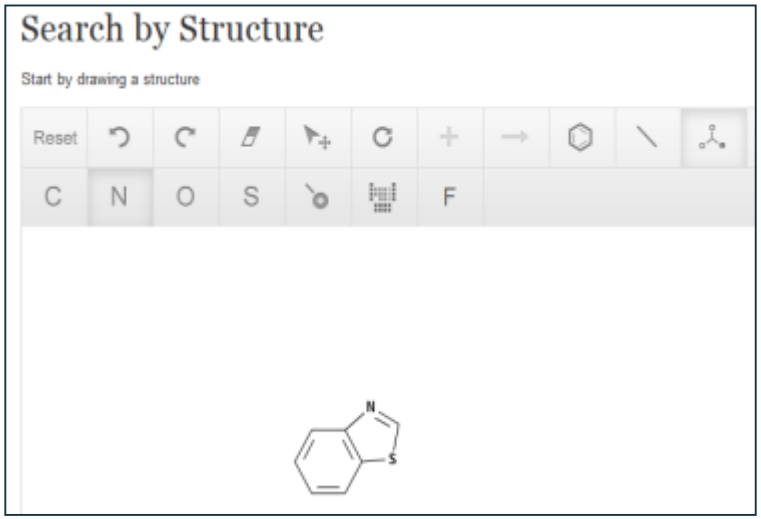


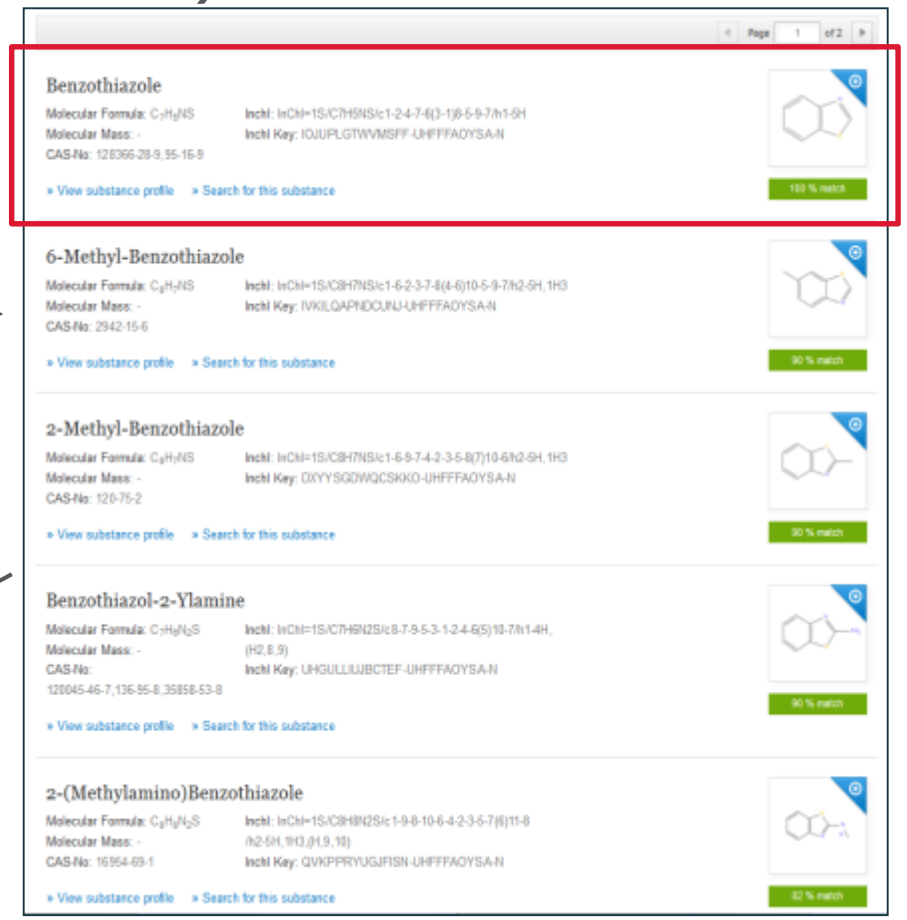


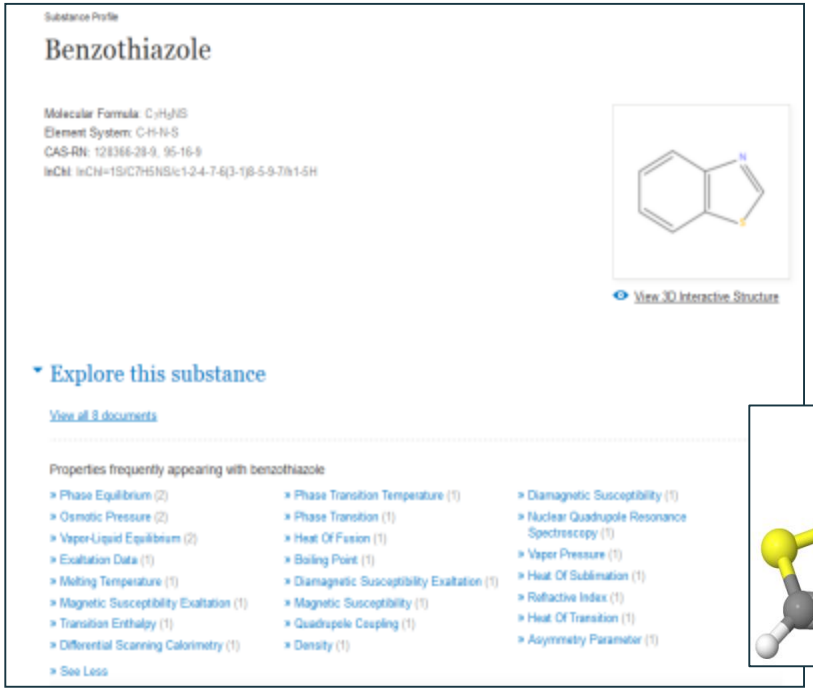


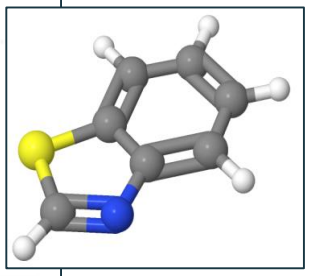
Chemical Structure Search

- Query: **苯并噻唑 /苯硫氮醇**（benzothiazole）









Corrosion Data Search

- Search and sort by material(s) and environment(s)

Corrosion Search

Seawater-301 stainless steel / 2Ni steel

Find out a corrosion rate and its relevant details by entering a material and/or environment into the search box below.

environment: Seawater × material: 301 stainless steel × material: 2Ni steel ×

Enter material and/or environment

7 results

Material	Environment	Rating
301 stainless steel	Seawater	A (Resistant) ≤ 0.125 mm/year
2Ni steel	Seawater	A (Resistant) 0.084 mm/year
2Ni steel	Seawater	A (Resistant) 0.1 mm/year
2Ni steel	Seawater	B (Good) 0.19 mm/year
301 stainless steel	Seawater	C (Questionable) 0.5 - 1.25 mm/year
2Ni steel	Seawater	Localized
2Ni steel	Seawater	Localized

Download this table (CSV format, UTF-8 encoded)

Corrosion Search

Find out a corrosion rate and its relevant details by entering a material and/or environment into the search box below.

material: Niobium ×

Enter material and/or environment

157 results

铌在硫酸（Niobium in sulfuric acid）

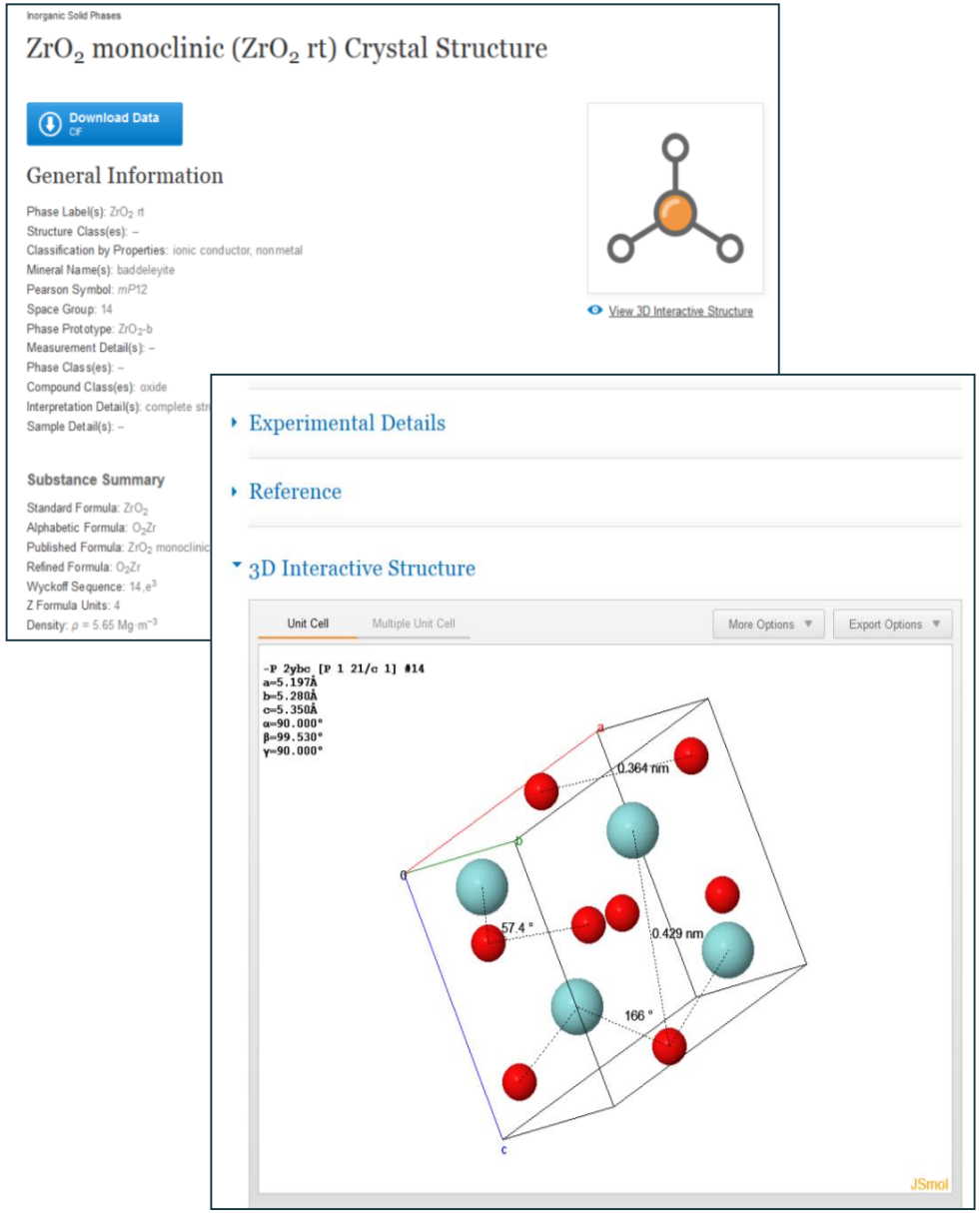
2 of 16

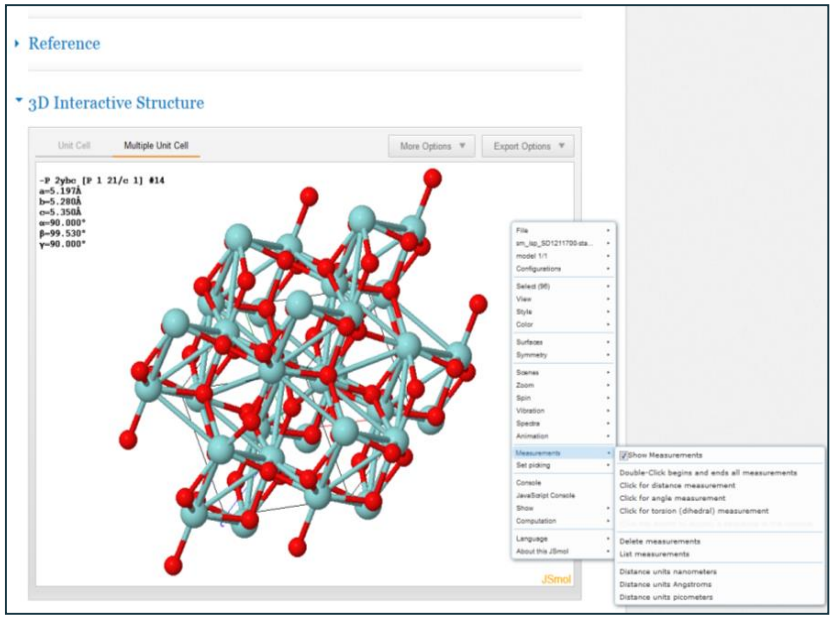
Material	Environment	Rating	Show all details
Niobium	Sulfuric Acid 98 %	A (Resistant) 5.0E-4 mm/year	
Condition: **UNS No:** R04210	**Temperature:** 19.0 °C - 26.0 °C **Reference:** Metals Handbook, Ninth Edition, Vol 13, Corrosion, ASM International, Metals Park, OH, 1987, p 730	**Duration:** 36 d **Localised attack:**	^ Less details
Niobium	Sulfuric Acid 72 %	A (Resistant) 0.1 mm/year	~ More details
Niobium	Sulfuric Acid 72 %	A (Resistant) 0.03 mm/year	~ More details
Niobium	Sulfuric Acid 50 %	A (Resistant) ≤ 0.125 mm/year	~ More details
Niobium	Sulfuric Acid 50 %	A (Resistant) ≤ 0.125 mm/year	~ More details

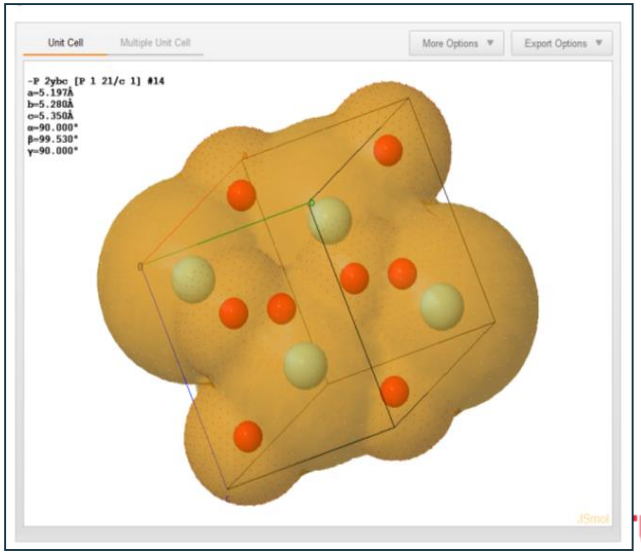
Crystallographic Data

- Built-in crystal structure viewer

ZrO2 monoclinic Crystal structure





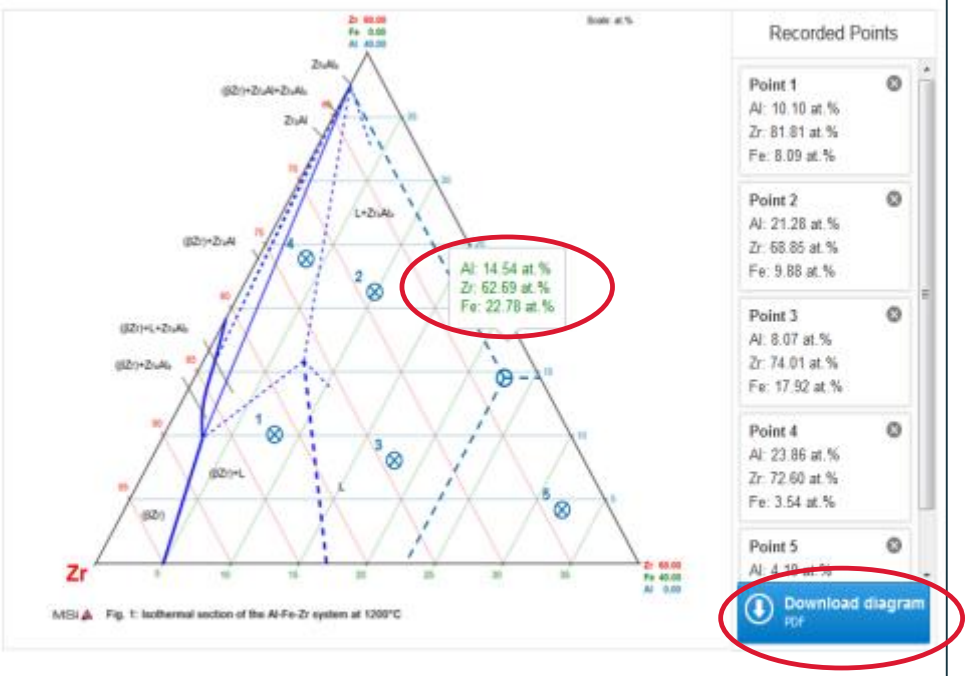


Phase Diagrams & Data Sliders

Interactive Phase Diagrams: (Al-Fe-Zr):

Isothermal section of the Al-Fe-Zr system at 1200°C

Figure 1 from evaluation report:
Al-Fe-Zr Ternary Phase Diagram Evaluation



General Information

Concentration Range: Fe conc. [0-40 at.%] vs. Al conc. [0-40 at.%] vs. Zr conc. [60-100 at.%]
Temperature: 1200 °C

Reference

Data Table Sliders:

Polymer Thermodynamics

Polyoxyoctamethylene (PO8M) Heat Capacity, Enthalpy, Entropy, Gibbs Energy

Substance Details

Polyoxyoctamethylene

Polymer code: PO8M
Substance class: Aliphatic Poly(oxide)s
CAS Number: –

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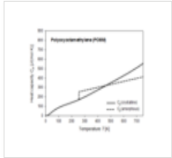

View Chart

Calculated and Experimental data

Calculated Data
Amorphous + Crystalline

Experimental Data
Crystalline

Filter data by:

Temperature [K]:

154.1 — 698.1

Hide Filter Tools

Temperature T [K]	Amorphous State					Crystalline State		
	Heat Capacity C_p [J/(K·mol)]	Enthalpy $H-H_0[c]$ [J/mol]	Entropy S [J/(K·mol)]	Gibbs Energy $H_0[c]-G$ [J/mol]	Note	Heat Capacity C_p [J/(K·mol)]	Enthalpy $H-H_0[c]$ [J/mol]	Entrop S [J/(K·m
160.000	119.9360	33381.0900	178.3540	-4844.4500	7	119.9360	10291.4300	114.97
170.000	124.8230	34604.5700	185.7630	-3024.8600	7	124.8230	11514.9000	122.38
180.000	129.7390	35877.4600	193.0470	-1129.0000	7	129.7390	12787.7900	129.66
190.000	134.6990	37199.1400	200.1740	833.9200	7	134.6990	14109.4700	136.79
200.000	139.7570	38571.9800	207.2300	2874.0200	7	139.7570	15482.3100	143.84
210.000	144.9390	39995.0500	214.1650	4979.6000	7	144.9390	16905.3800	150.78
220.000	150.2640	41471.0300	221.0400	7157.7700	7	150.2640	18381.3600	157.65

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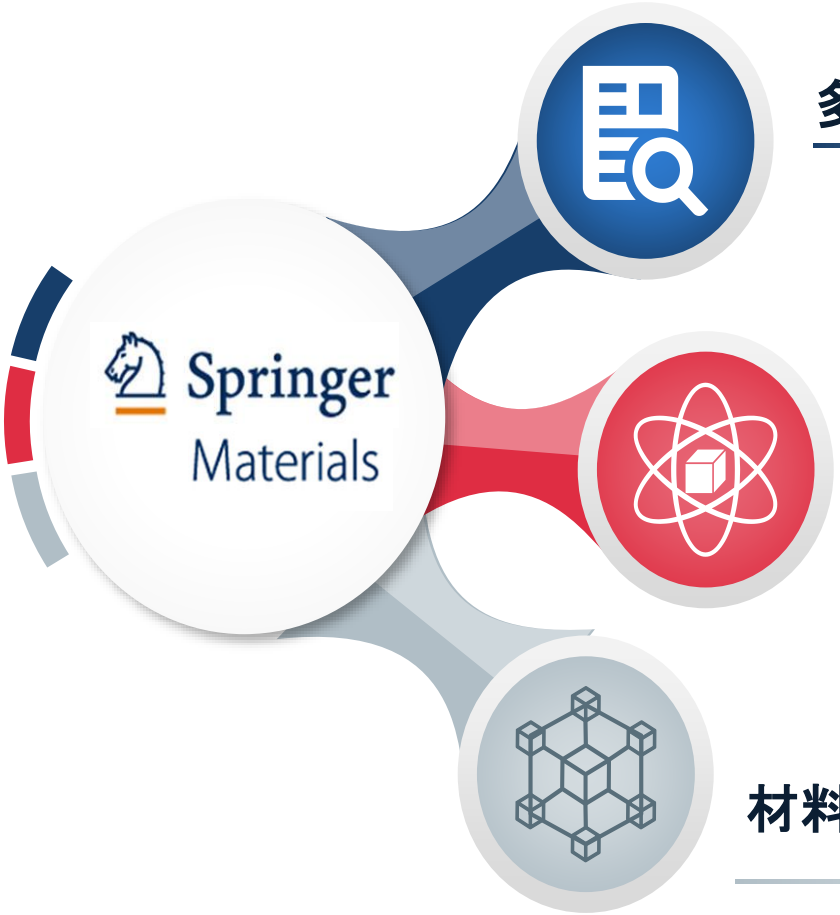

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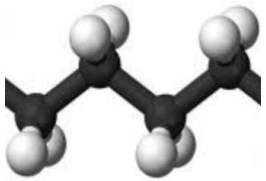

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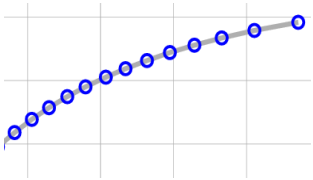

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C60

Properties

Magnetic susceptibility 125

29si Nuclear Magnetic Resonance Spectrum 2

Landolt-Börnstein - Group II Molecules and Radicals

Magnetic susceptibility exaltation data of C_{60}

This document is part of Subvolume C 'Diamagnetic Susceptibility and Magnetic Anisotropy of Organic Compounds' of Volume 27 'Diamagnetic Susceptibility and Anisotropy' of Landolt-Börnstein - Group II Molecul...

Gross formula	Structure	MSE (Λ)		Ref.
		$[-10^{-6}\ cm^3mol^{-1}]$	$[-10^{-12}\ m^3mol^{-1}]$	
C_{60}		94.0	1181.71	8, 22, 24

References

8. Schleyer, P.v.R., Jiao, H.: Pure Appl. Chem. **68** (1996) 209.
22. Kutzelnigg, W., Fleischer, U., Schindler, M.: In NMR Basic Principles and Progress, Springer Verlag, Berling, 1990, Vol.23, pp.167-262.
24. Schindler, M., Kutzelnigg, W.: J. Chem. Phys. **76** (1982) 1919.

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thermal conductivity of graphite

Landolt-Börnstein - Group III Condensed Matter

4.3.1 Thermal conductivity of graphite at room temperature

This document is part of Subvolume C 'Thermal Conductivity of Pure Metals and Alloys' of Volume 15 'Metals: Electronic Transport Phenomena' of Landolt-Börnstein - Group III Condensed Matter.

Graphite		T [K]	λ [W/m K]	σ [Ω^{-1} m^{-1}]	Heat treatment [°C]	Ref.
NC	(⊥)	289	356	$2.8 \cdot 10^5$	–	11Ko1
NC	(⊥)	300	420	$2.90 \cdot 10^5$	–	51Po1
	(‖)	300	~87	$4.3 \cdot 10^4$	–	51Po1
NC	(⊥)	300	240	$1.02 \cdot 10^5$	–	52Be1
	(‖)	300	75	$2.43 \cdot 10^4$	–	52Be1
NC	(⊥)	300	450	$7.7 \cdot 10^5$	–	54Sm1
PG [1])	(⊥)	300	580	$4.1 \cdot 10^5$	2100	56Br1
PG [2])	(⊥)	300	1900	$1.92 \cdot 10^6$		66Ho1
PG [3])	(⊥)	298	72	$1.85 \cdot 10^5$	2250	62Sl1
	(‖)	298	1.57	$1.99 \cdot 10^2$	2250	62Sl1
PG [4])	(⊥)	300	1980	–	3000	63Ho1
	(‖)	300	10	–	3000	63Ho1
	(⊥)	293	1750	–	3500, 10 bar	65Ho1
	(‖)	293	9.1	–	3500, 10 bar	65Ho1

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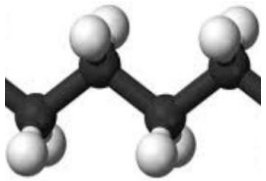

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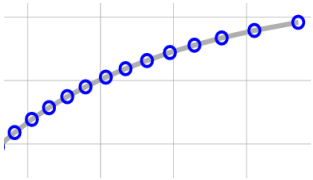

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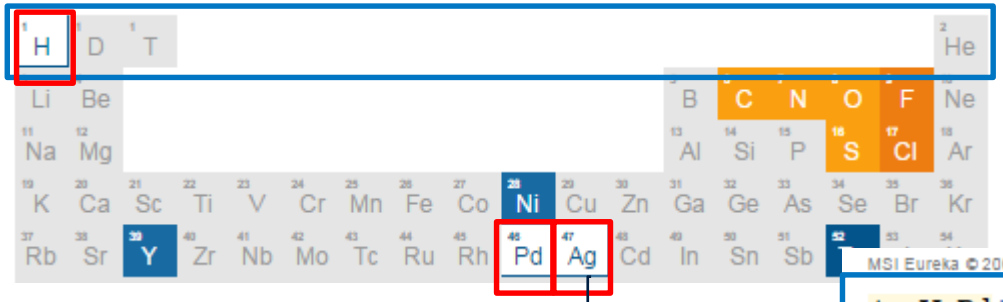

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Ag-H-Pd Ternary Phase Diagram Evaluation

Phase diagrams, crystallographic and thermodynamic data

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Ag-H-Pd Ternary Phase Diagram Evaluation

Phase diagrams, crystallographic and thermodynamic data

Materials Science International Team, MSIT ®[1], Pierre Perrot, Nele Moelans and Nathalie Lebrun

Abstract

This report for the ternary system Ag-H-Pd discusses literat
systems, solid phases, isothermal sections, thermodynamics
properties and applications.

Literature Data

While Pd absorbs readily large amounts of hydrogen at roor
hydrogen is practically insoluble in Ag. Despite this, the solu
larger in Ag-Pd alloys. The first measurements of the solubil
has been carried out at 15 and 100°C by [*1920Now*] which s
the solubility toward zero above 50 at.% Ag in the alloy, and

Notes on Materials Properties and Applications

The Ag-H-Pd system is of particular technological importance with respect to the separation and purification of the hydrogen gas. Ag-Pd alloys have high selectivity for hydrogen permeation and thus are suitable for hydrogen selective membranes [*2003Ton*]. Alloys containing more than 20 at.% Ag do not show two phased domains after hydridation above ambient temperature, and irreversible distortion due to the precipitation of a second phase with higher crystal parameter is thus avoided. The diffusivity of hydrogen is large in comparison with many metal-interstitial systems, which means that solid state equilibria can be studied at relatively low temperatures and than diffusivity can be measured over large temperature ranges [*2003Kur*]. The diffusivity of hydrogen at 30°C in the range 0-25 at.% Ag increases slightly with silver content of the alloy [*1970Zue*], and then decreases markedly above 25 at.% Ag [*1982Sak2*]. The activation energy for hydrogen diffusion reaches a minimum at about 15 at.% Ag.

设计方程

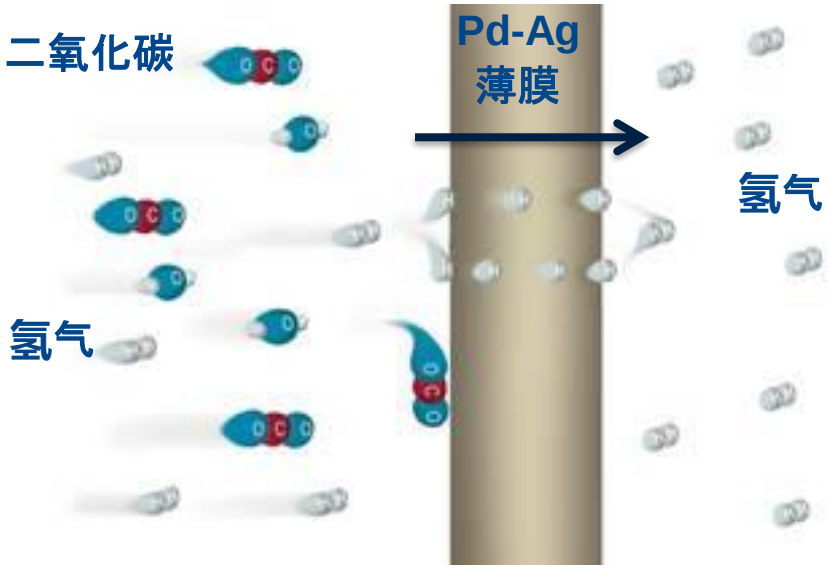
For $Pd_{0.75}Ag_{0.25}$ alloy, the permeability of H_2 is given by the following design equation:

$$R_{H2} = 46 \cdot 10^{-9} \left(\frac{A}{H}\right) \left(\rho_H^{\frac{1}{2}} - \rho_L^{\frac{1}{2}}\right) e^{\left(-\frac{794}{T}\right)} mol \cdot min^{-1}$$

Where A = membrane area (cm^2), H = membrane thickness (cm), ρ_H= driving pressure (Pa)

ρ_L = back pressure (Pa), T = temperature (K)

研究人员可以因应不同条件，
优化出最佳面积及厚度的薄膜进行氢气纯化。



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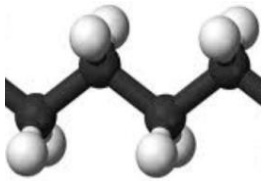

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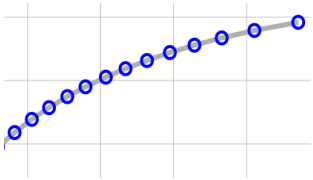

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Inorganic Solid Phases

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电子，催化剂，玻璃，
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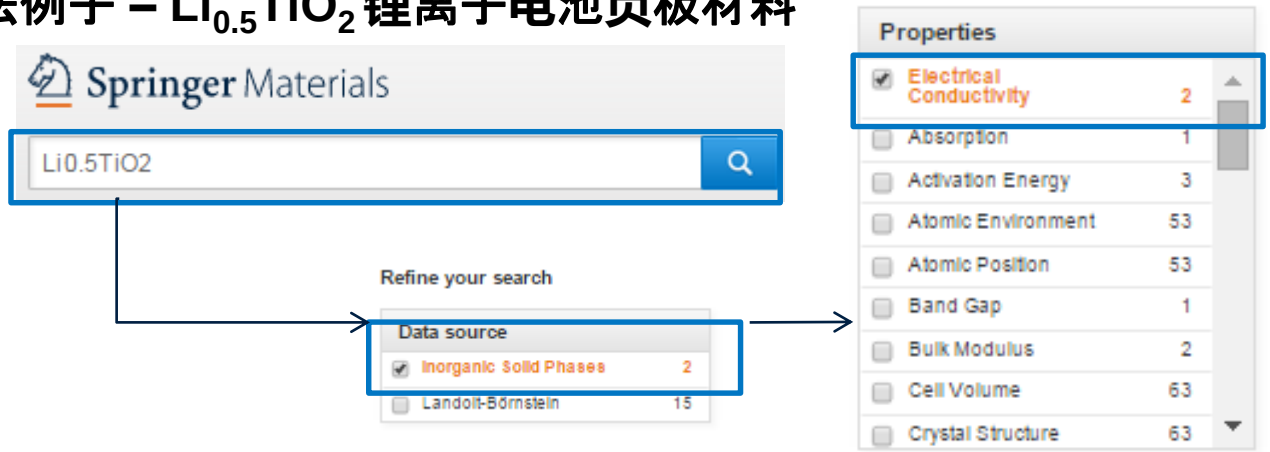
搜索方法例子 – $Li_{0.5}TiO_2$ 锂离子电池负极材料



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Inorganic Solid Phases

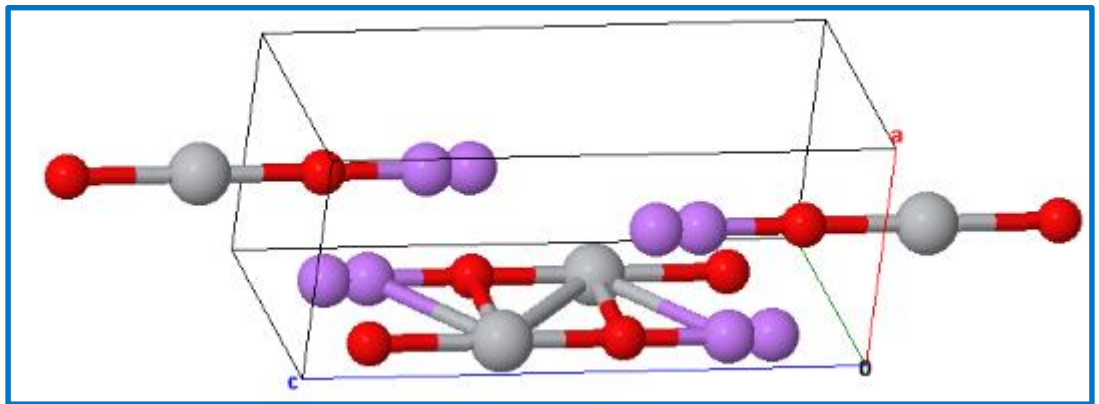
$Li_{0.5}TiO_2$ ht Electrical conductivity

Element system: Li-O-Ti; Phase prototype: $Li_{0.5}TiO_2$; Pearson symbol: oP16; Space group: 62.

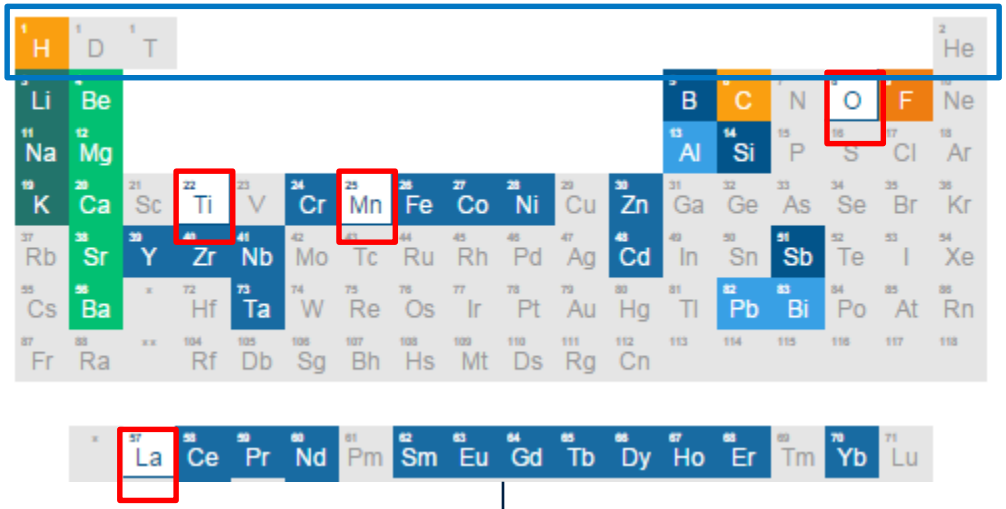
Data points: 18; Samples: 6; Journal references: 5.

$Li_{0.5}TiO_2$ 锂离子电池负极材料

Property	Temperature	Specimen Details	Remark	ISP ID
σ = 2.40 10^2 Ω^{-1} m^{-1}	T = 323 K	$Li_{0.5}Ti_{2.5}O_5$ sintered DSC, X-ray diffraction	–	P700032
σ = 6.92 10^2 Ω^{-1} m^{-1}	T = 423 K	$Li_{0.5}Ti_{2.5}O_5$ sintered DSC, X-ray diffraction	–	P700032
σ = 1.74 10^3 Ω^{-1} m^{-1}	T = 573 K	$Li_{0.5}Ti_{2.5}O_5$ sintered DSC, X-ray diffraction	–	P700032



反常电子态体系的 $LaMn_3Ti_4O_{12}$

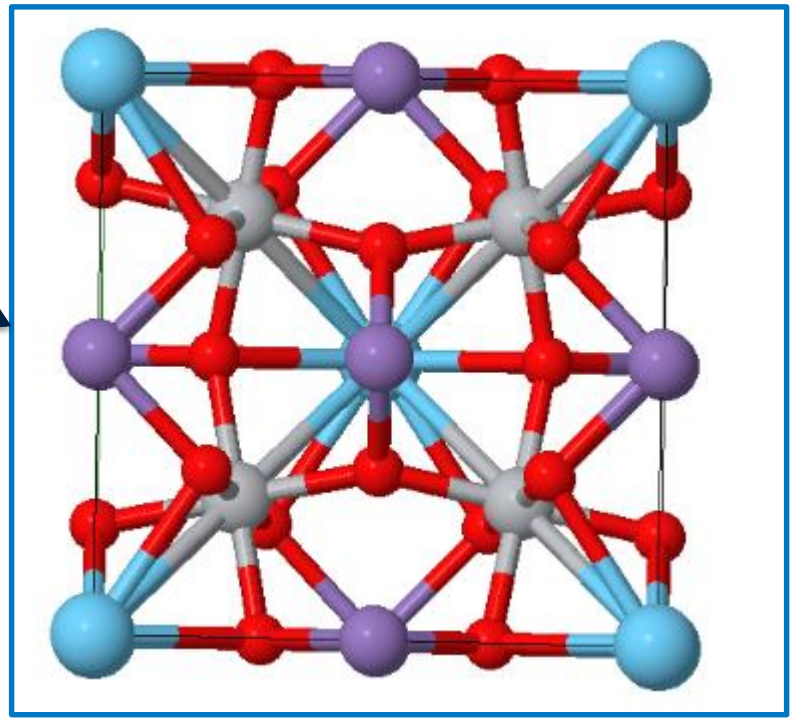


Inorganic Solid Phases

$LaMn_3Ti_4O_{12}$ ($LaTi_4Mn_3O_{12}$) Crystal Structure

Element system La-Mn-O-Ti, Phase prototype $CaCu_3Mn_4O_{12}$, Space group *cI*40, 204, Powder

Data on Cell parameters, Published and standardized atom coordinates, Isotropic displacement parameters



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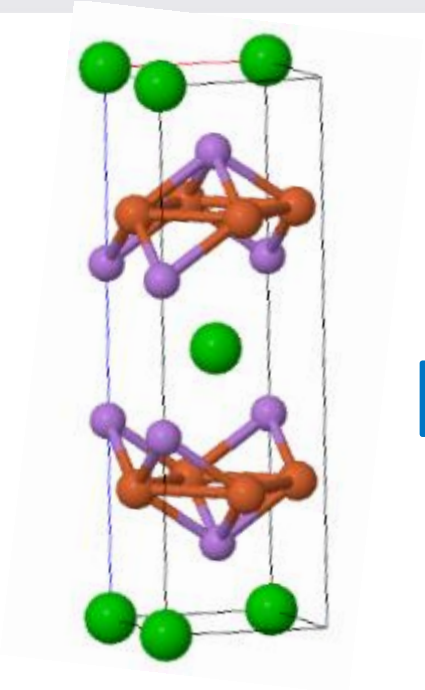
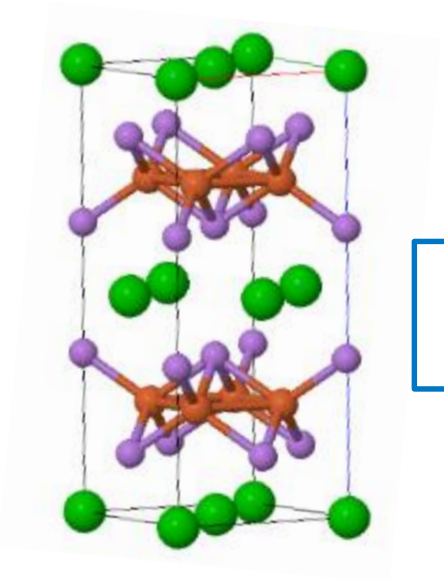


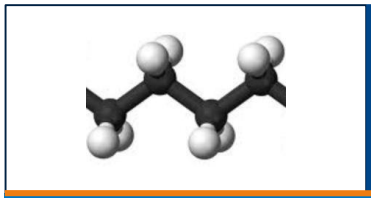
Inorganic Solid Phases

$BaFe_2As_2$ (T = 150 K, p = 2.32 GPa) Crystal Structure



$BaFe_2As_2$ low temperature ($BaFe_2As_2$ lt, T = 20 K) Crystal Structure

Polymer Thermodynamics



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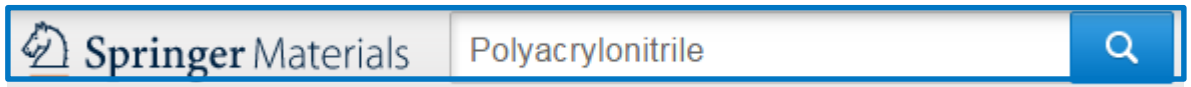
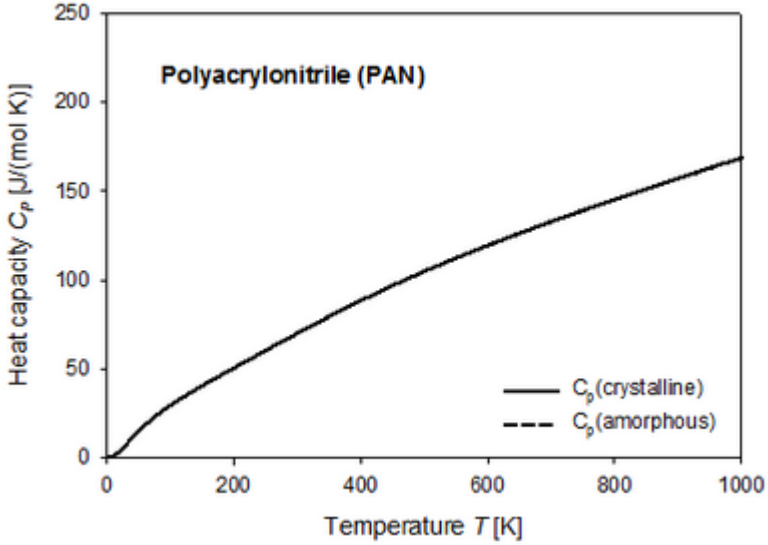
高分子数据 – 搜索方法例子, 聚丙烯腈(碳纤维原料)

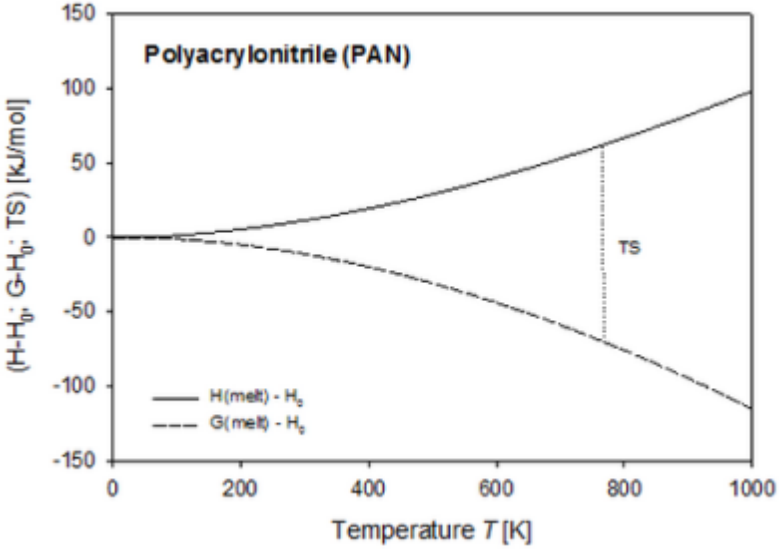


Polymer Thermodynamics

Polyacrylonitrile (PAN) Heat Capacity, Enthalpy, Entropy, Gibbs Energy

Temperature Range (0.100 ... 1000.000) K





Temperature T[K]	Amorphous State					Crystalline State		
	Heat Capacity C_p [J/(K·mol)]	Enthalpy $H-H_0$[c] [J/mol]	Entropy S [J/(K·mol)]	Gibbs Energy H_0[c]−G [J/mol]	Note	Heat Capacity C_p [J/(K·mol)]	Enthalpy $H-H_0$[c] [J/mol]	Entropy S [J/(K·mol)]
0.100	0.0000	0.0000	0.0000	0.0000	4	–	–	–
0.200	0.0000	0.0000	0.0000	0.0000	4	–	–	–
0.300	0.0000	0.0000	0.0000	0.0000	4	–	–	–
0.400	0.0000	0.0000	0.0000	0.0000	4	–	–	–

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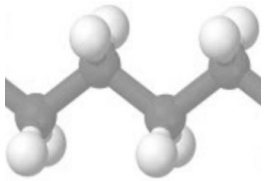
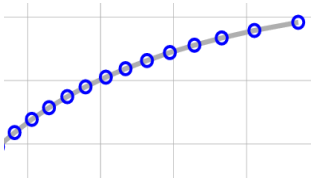


Advanced Thermal Analysis System (ATHAS) – 高分子的热物性数据

DDBST

Dortmund Data Bank Software & Separation Technology – 有机物质的热物性数据



等温吸附曲线数据库

腐蚀数据库

Thermophysical Properties

DDBST

Dortmund Data Bank Software & Separation Technology – Thermophysical Properties of Organic Mixtures

Dortmund Data Bank Software & Separation Technology –
有机混合物的热物性,
相平衡数据

1,225 二元混合物
及 51 物质,
472,000 数据点

适用研究范围:
油品提纯, 化工生产
(精细化工, 药物)

搜索方法例子, 甲醇及水的共沸数据

Temperature T [K]	Pressure p [kPa]	Azeotropic Type	Azeotropic Composition $x_{az,1}$ [mol/mol]	Azeotropic Composition $x_{az,2}$ [mol/mol]	Measurement Method	Evaluation	Reference
251.950	101.3	none	–	–	Phase equilibrium	DDBST from VLE	65. Kotsarenko (19
262.250	101.3	none	–	–	Phase equilibrium	DDBST from VLE	65. Kotsarenko (19
273.150	101.3	none	–	–	Phase equilibrium	DDBST from VLE	65. Kotsarenko (19
273.150	101.3	none	–	–	Phase equilibrium	DDBST from VLE	81. Dale (1976)

Download All Data
csv

SpringerMaterials: 内容总览

7个数据库，500,000+ 文档, 290,000+ 材料, 32,000 物性档 以及更多正在更新的内容

LANDOLT-BÖRNSTEIN

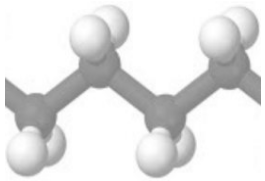
专家撰写综述及众多物性档案

MSI Science Simplified

专家撰写的报告以及互动相图

Linus Pauling

Inorganic Solid Phases
1.相图
2.化学及物理物性
3.晶体结构及数据



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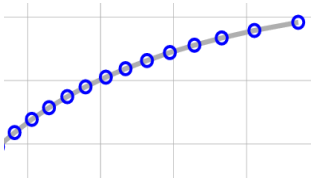
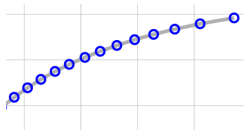


等温吸附曲线数据库

腐蚀数据库

Adsorption Isotherm Database



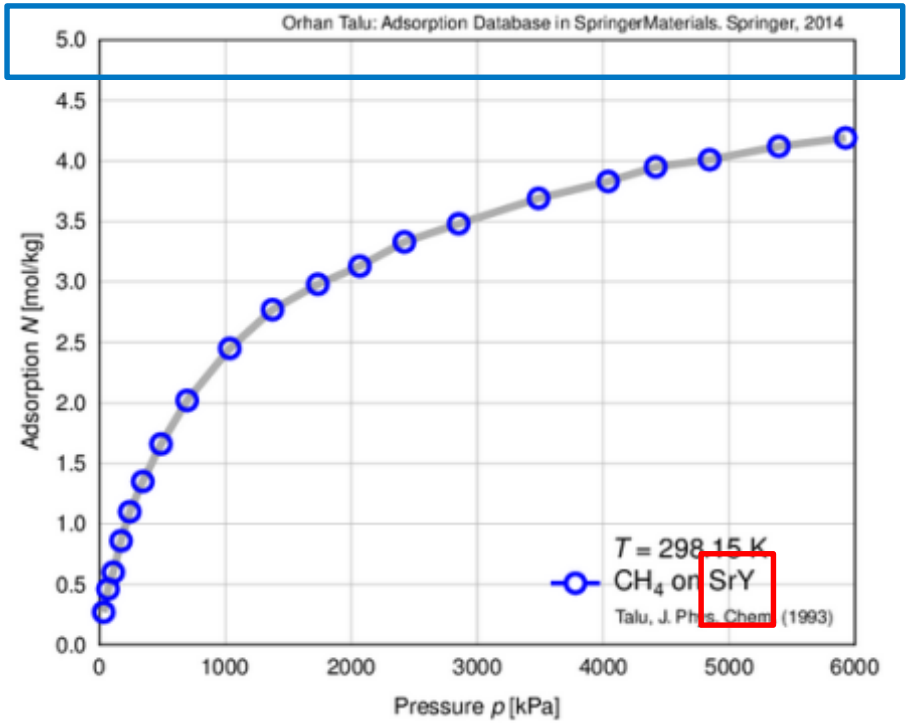
Adsorption Isotherm Database

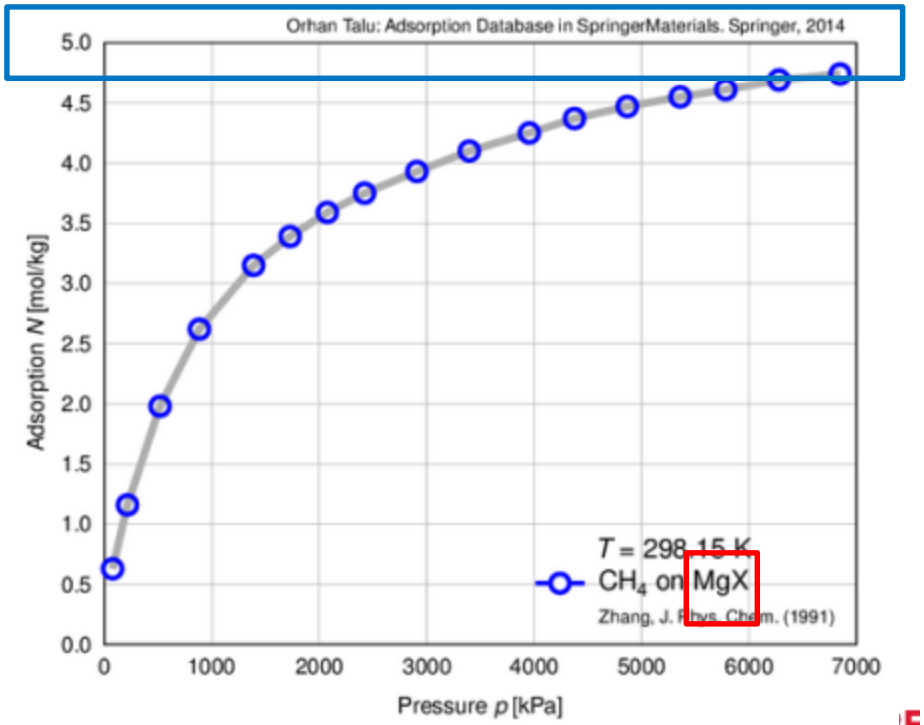
气体吸附在不同材料的等温吸附曲线

1,500 等温吸附图, and 66 种材料

适用研究范围:
化学处理/提纯,
燃料/能源,
传感, 生物材料

等温吸附数据 – 搜索方法例子, 甲烷吸附在不同的材料比较





Adsorption isotherm for methane on 2 different types of FAU zeolite

SpringerMaterials: 内容总览

7个数据库，500,000+ 文档, 290,000+ 材料, 32,000 物性档 以及更多正在更新的内容

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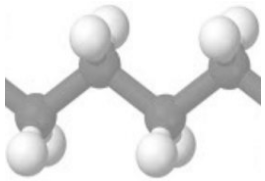

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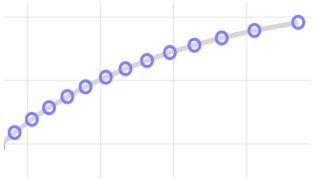
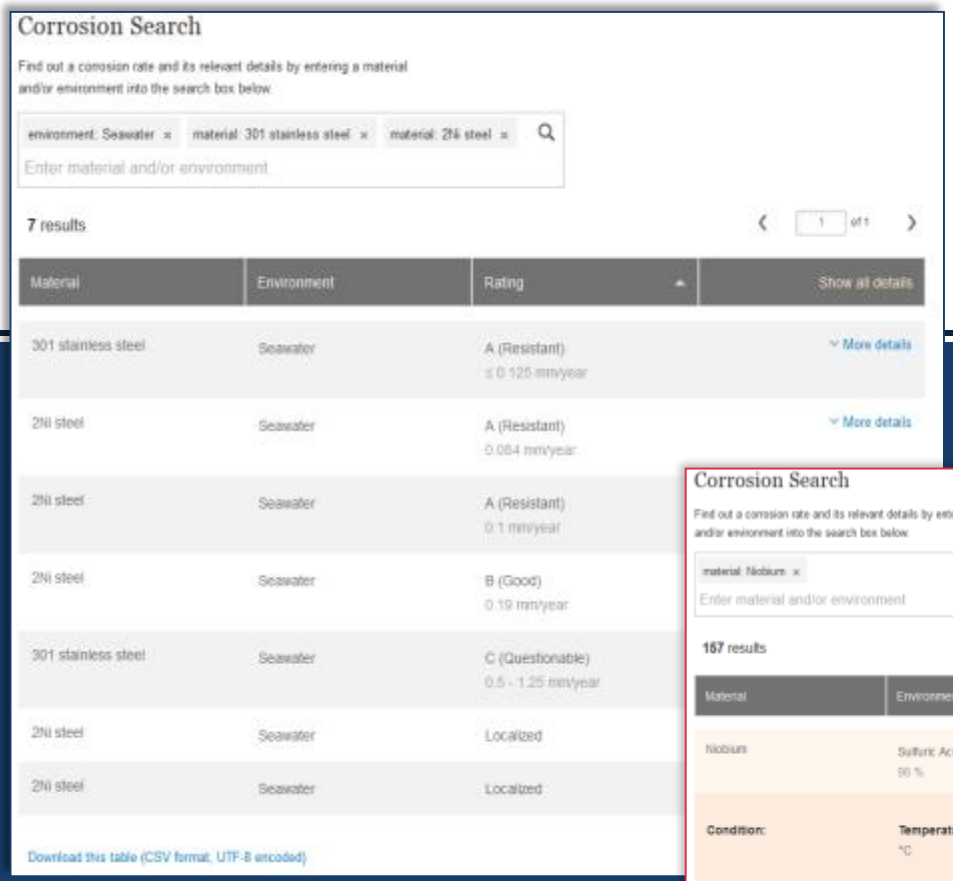


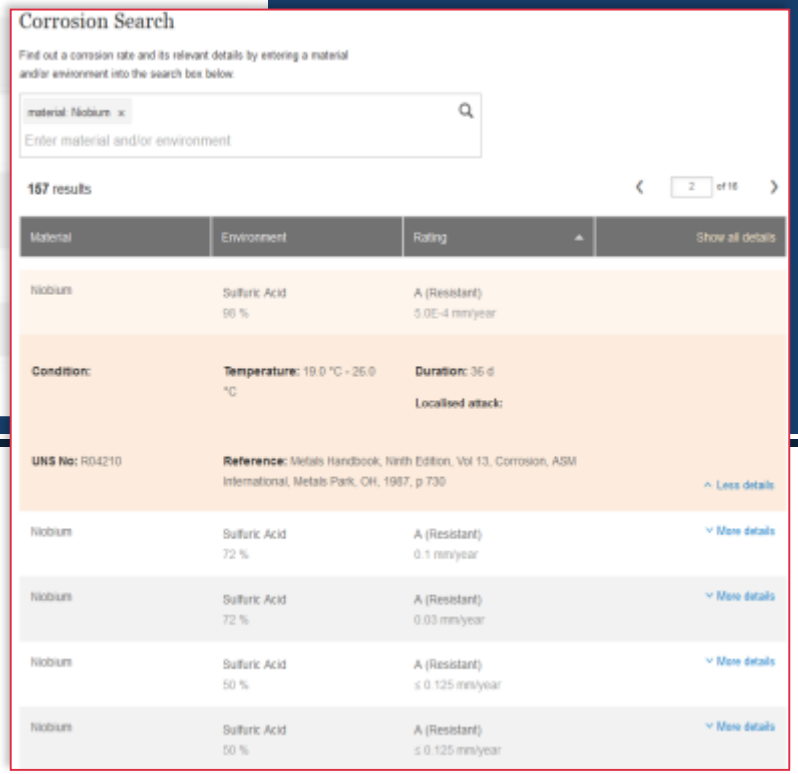
等温吸附曲线数据库

腐蚀数据库

Corrosion Data Search

- *25,000+ 词条*
- *1000+ 金属和合金*
- *275+ 环境*





Search & Sort by Material(s) & Environment(s)

SPRINGER NATURE

Handbook
数据手册

分类	手册
高分子	Physical Properties Of Polymers Handbook
纳米材料	Handbook of Polymernanocomposites. Processing, Performance and Application
	Handbook of Nanomaterials Properties
	Raman Spectroscopy for Nanomaterials Characterization
	Transmission Electron Microscopy Characterization of Nanomaterials
	UV-VIS And Photoluminescence Spectroscopy for Nanomaterials Characterization
物理	Handbook of Theoretical Atomic Physics
	Handbook of Spectral Lines in Diamond
化工	VDI Heat Atlas

多铁性材料

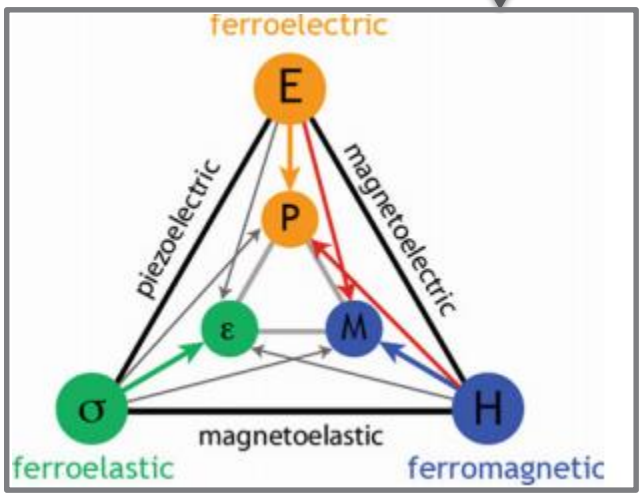
Springer Materials

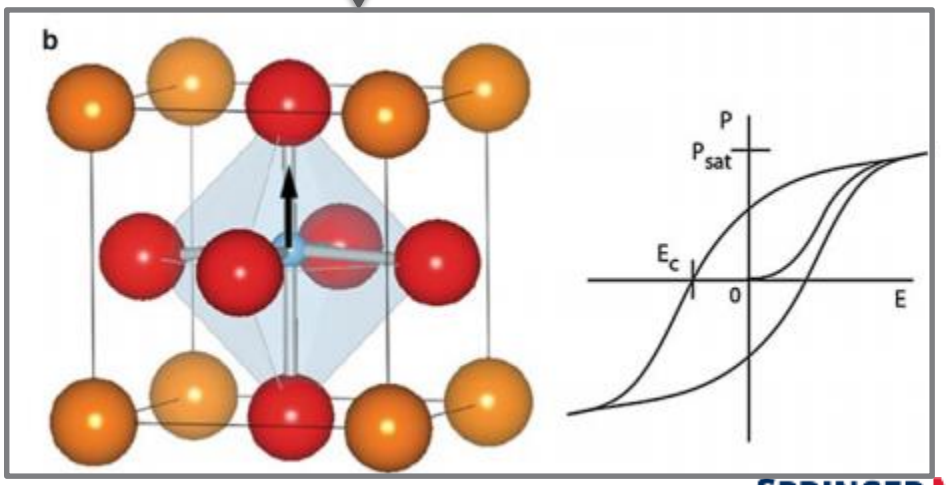
ferroic

多铁材料是一类由自旋、电荷、晶格和轨道等多种自由度的相互作用引起的具有2种或者2种以上铁序的功能材料

Properties of Ferroic Nanomaterials

Ferroic materials have attracted a significant amount of attention due to their ability to be polarized in an applied external field. This polarization response lends these materials to a wide v...





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SpringerMaterials 总更新内容 4.8%

新内容:

+12本 Landolt Börnstein

+ 4 本 SpringerMaterials Fundamentals

Inorganic Solid Phases (Linus Pauling Files) **更新**:
+ 15k 页晶体数据 (+7%)
+ 1.5k 相图 (+4%)
+ 23K 物理性质的数据点 (+9%)

MSI Eureka:

+70专家撰写的报告

+10k文献报告

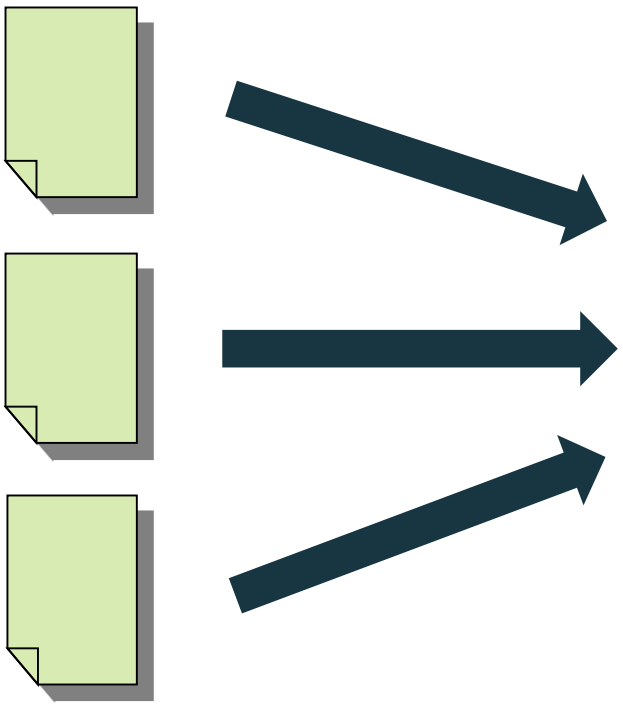
NMR： (Oxygen (17O) and Sulfur (33S) NMR data)

发布时间	March 27th (digitized data)	June 26th
	September 18th	November 27th

Digitization, Enrichment, and Consolidation of Data

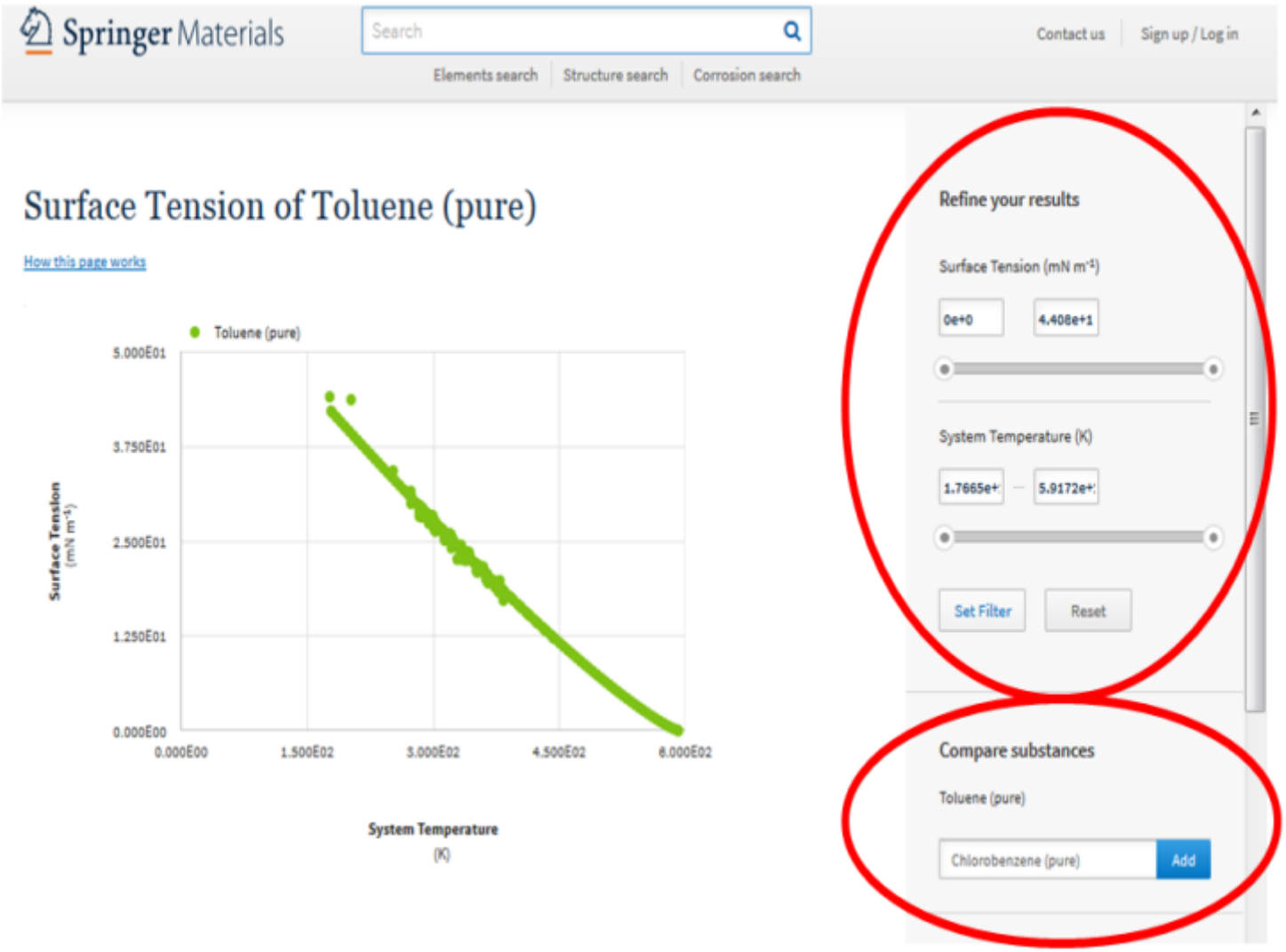
Consolidated View: Extract data from several documents and show only one data set

Advantage: No longer look through large result sets



E_{g-dir}= 2.83 eV	T = 0 K	GaP	Γ15v-Γ1c, calculated	P608509	172909. Scheffler (1984)
E_{g-ind}= 2.36 eV	T = 0 K	GaP	approximate value Γ15v-X1c, calculated from fig. 1	P608509	172909. Scheffler (1984)
E_{g-dir}= 2.88 eV	T = 0 K	GaP	calculated value for Γ15v - Γ1c transition	P900452	83949. Chen (1980)
E_{g-ind}= 2.16 eV	T = 0 K	GaP	calculated value for Γ15v - X1c transition	P900452	83949. Chen (1980)
E_{g-ind}= 2.79 eV	T = 0 K	GaP	calculated value for Γ15v - L1c transition	P900452	83949. Chen (1980)

Customized view: Select only relevant data sets



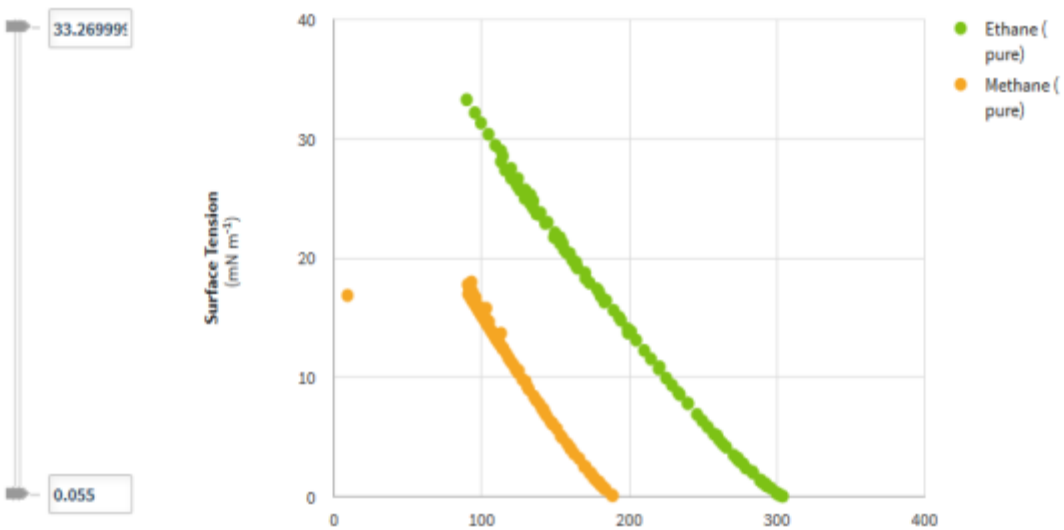
Sliders allow customization of data sets

Comparative view: Compare materials based on their property

Surface Tension of Ethane (pure) vs Surface Tension of Methane (pure)

Download

Data plot



Easily compare data sets and plots based on individual queries

Reverse search: Show all materials with a given property range

Springer Materials

surface tension >0.06mNm-1

Substance	Surface Tension (mN m^{-1})	System Temperature (K)	External Reference	Internal Reference
Ethane (pure)	0.06	303.99	Baidakov (1987)	LB IV/16, Pure Liquids: Data
Methane (pure)	0.10	188.84	Holcomb (1992)	LB IV/16, Pure Liquids: Data
Ethane (pure)	0.13	302.44	Baidakov (1987)	LB IV/16, Pure Liquids: Data
Methane (pure)	0.17	188.06	Blagoi (1970)	LB IV/16, Pure Liquids: Data

Quickly identify materials suitable for a given application

SpringerMaterials Competitors at a Glance

- No "true" competitors to SpringerMaterials:
  - No other product has all same content scope/depth & features
  - Other databases may compete with specific content sections of SpringerMaterials
- Scientific databases complement rather than directly compete with each other

	SciFinder	Reaxys	Web of Science	Total Materia	Knovel	ThermoCalc
Database Type	Indexing	Indexing	Indexing	Interactive/ Workflow	Interactive/ Workflow	Interactive/ Workflow
Description	Chemistry literature and substance searching	Chemical data for (organic) chemistry & reactions; synthesis	Bibliometrics & citation indexing	Metals & engineering properties database	Engineering data & analytical tools	Materials properties simulation software
Publisher	American Chemical Society	Elsevier	Thomson Reuters	Key to Metals AG	Elsevier	Thermo-Calc Software Inc.
Target Audience	Chemists and chemically-related researchers	Organic chemists in materials & pharma research	STM and HSS researchers	Engineers, corporate researchers	Engineers and engineering researchers	Materials science researchers
	SciFinder A CAS SOLUTION	REAXYS	WEB OF SCIENCE	Total Materia	Knovel	Thermo-Calc Software