SpringerMaterials

How a 127 year old handbook has morphed into a web database

Thomas Mager, Springer, 3 December 2010
It all began in 1882…
Hammering Man in Frankfurt

OR

195,000 pages = 397 LB
Vols. = 24 m piled up
What is Landolt-Börnstein now?

- > 200,000 pages | > 100,000 online documents | > 150,000 figures

- > 250,000 chemical substances | > 1,200,000 literature references

- Systematic and comprehensive evaluation of data by renowned authors and editors (... since 1883)
What is in Landolt-Börnstein?

Chemical Substance + Physical Property
Strategy: The SpringerMaterials Database Cube

Sub-cube „Thermal properties of chalcogen hydrides“
### Each Document Comprises Three Layers

#### Layer 1
What the User Can See

<table>
<thead>
<tr>
<th>Phase/ Temperature Range</th>
<th>Pearson Symbol/Temperature</th>
<th>Lattice Parameters [pm]</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiAl ≤ 1400</td>
<td>aP4</td>
<td>a = 400.0</td>
<td>[2003Sck], at 50 at% Ti. Solid solubility ranges from 33.5 to 63.3 at% Ti [2003Sck].</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 407.5</td>
<td>[2003Sck], at 38 at% Ti.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = 398.1</td>
<td>[2004Mbh], at 47 at% Ti.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 406.0</td>
<td>Heat treated at 1000°C for 48 h followed by water quench.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = 399.6</td>
<td>1999Cor], A_{394}Fe_{0.3}, Ti_{0.4}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = 407.7</td>
<td>[1999Cor], A_{394}Fe_{0.2}T_{11.3}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 406.7</td>
<td>1999Cor], A_{394}Fe_{0.2}T_{11.3}</td>
</tr>
<tr>
<td>TiAl ≥ 1164</td>
<td>A28</td>
<td>a = 580.6</td>
<td>[2003Sck], at 78 at% Ti. Solid solubility ranges from 61.3 to 86 at% Ti [2003Sck].</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 465.5</td>
<td>[2003Sck], at 62 at% Ti.</td>
</tr>
<tr>
<td></td>
<td>N5</td>
<td>a = 546.6</td>
<td>[2003Sck], at 62 at% Ti.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 462.4</td>
<td>1999Cor], A_{384}Fe_{0.3}, Ti_{0.8}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = 561.1</td>
<td>1999Cor], A_{384}Fe_{0.3}, Ti_{0.8}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 462.4</td>
<td>1999Cor], A_{384}Fe_{0.3}, Ti_{0.8}</td>
</tr>
<tr>
<td>α1, Fe3Al ≤ 352.5</td>
<td>cP12</td>
<td>a = 578.86 to 579.3</td>
<td>[2003Pin], solid solubility ranges from 22.5 to 16.3 at% Al. Labelled as D8′ (L2_2) in isothermal sections.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 482.3</td>
<td>1999Cor], A_{322}Fe_{0.3}, Ti_{12}</td>
</tr>
<tr>
<td></td>
<td>B1</td>
<td>a = 289.76 to 290.71</td>
<td>[2003Pin], at room temperatures solid solubility ranges from 22.0 to 54.5 at% Al.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 408.5</td>
<td>Labelled as R2 in isothermal sections.</td>
</tr>
<tr>
<td></td>
<td>C15</td>
<td>a = 318.4</td>
<td>[1996Cor], A_{322}Fe_{0.3}, Ti_{12}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 318.4</td>
<td>1999Cor], A_{324}Fe_{0.3}, Ti_{12}</td>
</tr>
<tr>
<td>α2, Fe3Al ≤ 1140</td>
<td>aP2</td>
<td>a = 289.76 to 290.71</td>
<td>[2003Pin], at room temperatures solid solubility ranges from 22.0 to 54.5 at% Al.</td>
</tr>
<tr>
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<td></td>
<td>c = 408.5</td>
<td>Labelled as R2 in isothermal sections.</td>
</tr>
<tr>
<td></td>
<td>C15</td>
<td>a = 318.4</td>
<td>[1996Cor], A_{322}Fe_{0.3}, Ti_{12}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 318.4</td>
<td>1999Cor], A_{324}Fe_{0.3}, Ti_{12}</td>
</tr>
<tr>
<td>α3, Fe3Al1H62-12312</td>
<td>c147</td>
<td>a = 598.0</td>
<td>[2003Pin], solid solubility ranges from 54.5 to 62.5 at% Al</td>
</tr>
<tr>
<td>FeAl2 ≤ 1156</td>
<td>aP1</td>
<td>a = 487.8</td>
<td>[2004Pau], at 66 at% Al. solid solubility ranges from 53.5 to 67.9 at% Al</td>
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<tr>
<td></td>
<td></td>
<td>b = 666.1</td>
<td>1995Pau], contains about 1.8 at% Ti</td>
</tr>
<tr>
<td></td>
<td>FeAl3</td>
<td>c = 880.0</td>
<td>1995Pau], contains about 1.8 at% Ti</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = 91.7°</td>
<td>1995Pau], contains about 1.8 at% Ti</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b = 73.1°</td>
<td>[1995Pau], contains about 1.8 at% Ti</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = 96.3°</td>
<td>[1995Pau], contains about 1.8 at% Ti</td>
</tr>
<tr>
<td></td>
<td></td>
<td>γ = 96.3°</td>
<td>[1995Pau], contains about 1.8 at% Ti</td>
</tr>
</tbody>
</table>
Each Document
Comprises
Three Layers

Layer 2
What the SpringerLink
Search Engine Can Find
Each Document Comprises Three Layers

Layer 3
What the Springer Materials Search Engine Can Find
Three Layers per Doc

A Closer Look

Required Resource

Expert knowledge-based editing process

Computerized scanning and OCR

Traditional typesetting and layouting
### A Closer Look

Three Layers per Doc

A closer look at the data for the FeAl<sub>2</sub> phase:

- **Lattice parameter**
- **Unit cell axis angle**
- **Space group**
- **Pearson symbol**
- **Solid solubility**

#### <Al-Fe>
#### <FeAl₂>
#### <Lattice parameter>
#### <Unit cell axis angle>
#### <Space group>
#### <Pearson symbol>
#### <Solid solubility>

#### <Ti[2003Sch]>
#### <FeAl₂>
#### <Solid>
#### <Solubility>
#### <Ranges>
#### <From>
#### <33.5>
#### <□>

Solid solubility ranges from 33.5 to 53.3 at% Ti[2003Sch].

- For FeAl<sub>2</sub>, the solid solubility is limited to 33.5 at% Ti.
- At 47 at% Ti, heat treated at 1000°C for 48h followed by water quench, no indexing possible.

### Table: FeAl₂ Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lattice parameter</td>
<td>a = 487.8, b = 646.1, c = 830.0, α = 91.75°, β = 73.27°, γ = 96.89°</td>
</tr>
<tr>
<td>Solid solubility</td>
<td>From 33.5 to 53.3 at% Ti</td>
</tr>
</tbody>
</table>

No indexing possible.
Summary

SpringerMaterials: You look at a PDF, you search in a database!

Three Layers per Doc

A Closer Look

Usability

What the user sees

What the user can find with the SpringerMaterials search engine

What the user can find with the SpringerLink search engine

SpringerMaterials: easy to understand but not searchable

precise search result

wrong search result

What the user sees
Multiphase Systems > Ternary Alloys > Phase Diagrams, Crystallography and Thermodynamics > Light Metal Systems > Aluminum (Al-X-Y) Ternary Alloys

Al-Cu-Fe

Metadata: ...Al-Cu-Fe ThFe4SiAl8 Al-Fe-Ti FeTiAl1-x Ti-Fe-Al Ti0.5FeAl0.5-x (Ti3SiAl)x1-4xFe...

...Systems from Al-Cu-Fe to Al-Fe-Ti Part 2

Part 2

Magnetism > Actinides > Elements and Compounds

Index of substances

...Al-Fe-Th ThFe4SiAl8 Al-Fe-Ti FeTiAl1-x Ti-Fe-Al Ti0.5FeAl0.5-x (Ti3SiAl)x1-4xFe...

...to be similar to the Al-Fe-Ti system, assessed in the same paper and...

Multiphase Systems > Ternary Alloys > Phase Diagrams, Crystallography and Thermodynamics > Light Metal Systems > Aluminum (Al-X-Y) Ternary Alloys

Al-Co-Ti

...Systems from Al-Cu-Fe to Al-Fe-Ti Part 2 Selected Systems from Al-Fe-V...
Search for Element Systems

Select elements by clicking on the symbols. Deselect elements by clicking a second time.

Your Selection
Al-Fe-Ti

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Time’s Up!

About your speaker:
Name: Dr Thomas Mager
Company: Springer
Tel:  +49 6221 4878112
Email: thomas.mager@springer.com
Social Media: LinkedIn, Xing