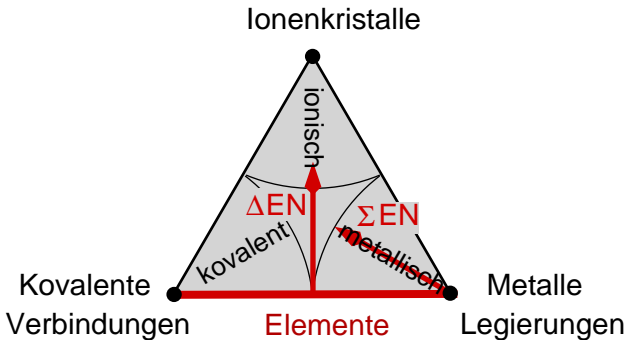


| | | | | |
|----|-----|----|----|----|
| Li | Ber | B | C | F |
| Na | Mg | Al | Si | P |
| K | Ca | Ga | Ge | As |
| Rb | Sr | In | Sn | Sb |
| Cs | Ba | Tl | Pb | Bi |

Bindungstypen nach EN



An der
Zintl-
Grenze

Einleitung

I-IV

AM

M_9 -Cluster

Clathrate

I-III

AM

AM_{3-7}

II-IV

II-III

AM_2

AM

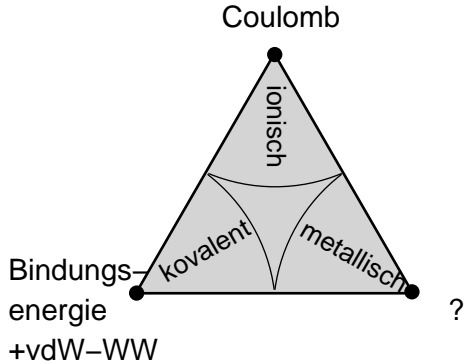
A_2M_5

II-III-IV

Zusammen-
fassung

| | | | | | | |
|----|----|----|----|----|----|----|
| Li | Be | B | C | N | O | F |
| Na | Mg | Al | Si | P | S | Cl |
| K | Ca | Ga | Ge | As | Se | Br |
| Rb | Sr | In | Sn | Sb | Te | I |
| Cs | Ba | Tl | Pb | Bi | Po | At |

Stabilität?



An der
Zintl-
Grenze

Einleitung

I-IV
AM
M₉-Cluster
Clathrate

I-III
AM
AM₃₋₇

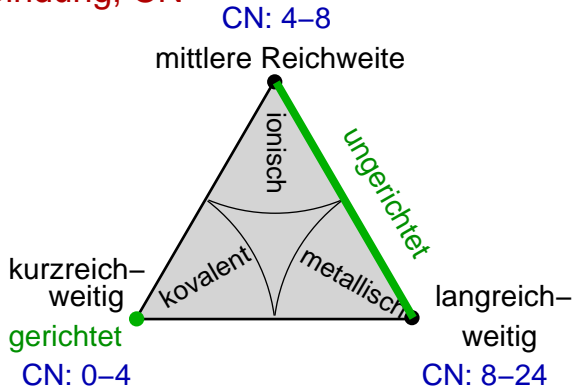
II-IV
II-III
AM₂
AM
A₂M₅

II-III-IV

Zusammen-
fassung

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|--------|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Li | Be | B | C | N | O | F | | | | | | | | | | | | | | | | | | | | | |
| Na | Mg | Al | Si | P | S | Cl | Ar | | | | | | | | | | | | | | | | | | | | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Cobalt | Nickel | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | | | | | | | | | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | | | | | | | | | | |
| Cs | Ba | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tm | Yb | Lu | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |

Bindung, CN

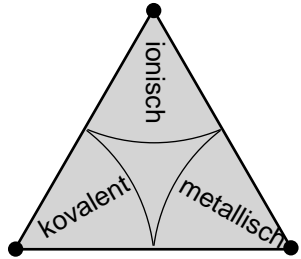


- An der Zintl-Grenze
- Einleitung
- I-IV
- AM
- M₉-Cluster
- Clathrate
- I-III
- AM
- AM₃₋₇
- II-IV
- II-III
- AM₂
- AM
- A₂M₅
- II-III-IV
- Zusammenfassung

| | | | | | |
|----|----|----|----|----|----|
| Li | Be | B | C | N | O |
| Na | Mg | Al | Si | P | S |
| K | Ca | Ga | Ge | As | Se |
| Rb | Sr | In | Sn | Sb | Te |
| Cs | Ba | Tl | Pb | Bi | Po |

Radien/Größen

Ionenradien
(Shannon)



kovalente
Einfachbindungsradien
(intra) und
v.d.W.-Radien (inter)

metallische
Radien
(Gschneidner)

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M₉-Cluster

Clathrate

I-III

AM

AM₃₋₇

II-IV

II-III

AM₂

AM

A₂M₅

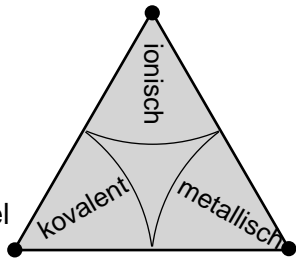
II-III-IV

Zusammen-
fassung

| | | | | | | |
|----|----|----|----|----|----|----|
| Li | Be | B | C | N | O | F |
| Na | Mg | Al | Si | P | S | Cl |
| K | Ca | Ga | Ge | As | Se | Br |
| Rb | Sr | In | Sn | Sb | Te | I |
| Cs | Ba | Tl | Pb | Bi | Po | At |

Struktur-Konzepte

Madelung, Pauling-Regeln



8-N-Regel
VSEPR
Wade-Regeln
MO-Theorie

dichte Packungen ?

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M_9 -Cluster

Clathrate

I-III

AM

AM_3 -₇

II-IV

II-III

AM_2

AM

A_2M_5

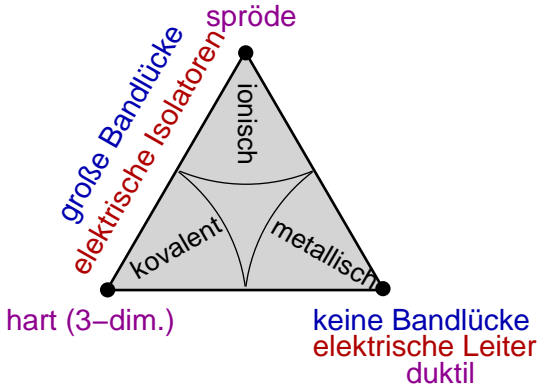
II-III-IV

Zusammen-
fassung

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|--------|--------|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|
| Li | Be | B | C | N | O | F | | | | | | | | | | | | | | | | | | | | | | | | | |
| Na | Mg | Al | Si | P | S | Cl | Ar | | | | | | | | | | | | | | | | | | | | | | | | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Cobalt | Nickel | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | | | | | | | | | | | | | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | | | | | | | | | | | | | | |
| Cs | Ba | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |

Ketelaar-Dreieck: Konzepte der chemischen Bindung

Eigenschaften



An der
Zintl-
Grenze

Einleitung

I-IV
AM
M₉-Cluster
Clathrate

I-III
AM
AM₃₋₇

II-IV

II-III
AM₂
AM
A₂M₅

II-III-IV

Zusammen-
fassung

| | | | |
|----|----|----|----|
| Li | Be | B | C |
| Na | Mg | Al | Si |
| K | Ca | Ga | Ge |
| Rb | Sr | In | Sn |
| Cs | Ba | Tl | Pb |

PSE

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M₉-Cluster

Clathrate

I-III

AM

AM₃₋₇

II-IV

II-III

AM₂

AM

A₂M₅

II-III-IV

Zusammen-
fassung

| 1 | 2 | | | | | | | | | | | III | IV | V | VI | VII | VIII | |
|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|-----|------|----|
| I | II | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 | |
| H | | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne | |
| Na | Mg | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Al | Si | P | S | Cl | Ar | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | |
| Fr | Ra | Ac | Db | Jl | Rf | Bh | Hn | Mt | | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | |

| | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Li | Be | B | C | N | O | F | Ne | | | | | | | | | | |
| Na | Mg | Al | Si | P | S | Cl | Ar | | | | | | | | | | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Db | Jl | Rf | Bh | Hn | Mt | | | | | | | | | |
| | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | |
| | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | |

PSE

zu einfach

| | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|-----|----|----|----|-----|------|
| | 1 | 2 | | | | | | | | | | | | | | | | | III | IV | V | VI | VII | VIII |
| | I | II | | | | | | | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 |
| | H | | | | | | | | | | | | | | | | | | B | C | N | O | F | Ne |
| | Li | Be | | | | | | | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| | Na | Mg | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | | | | | | | | |
| | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | | | | | | Kr | |
| | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | | | | | | Xe | |
| | Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | | | | | | Rn | |
| | Fr | Ra | Ac | Db | Jl | Rf | Bh | Hn | Mt | | | | | | | | | | | | | | | |
| | | | ↑ | | | | | | | | | | | | | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | | | | | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | | | | | | |

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M₉-Cluster

Clathrate

I-III

AM

AM₃₋₇

II-IV

II-III

AM₂

AM

A₃M₅

II-III-IV

Zusammen-
fassung

| | | | |
|----|----|----|----|
| Li | Be | B | C |
| Na | Mg | Al | Si |
| K | Ca | Ga | Ge |
| Rb | Sr | In | Sn |
| Cs | Ba | Tl | Pb |

PSE

- An der Zintl-Grenze
- Einleitung
- I-IV
- AM
- M₉-Cluster
- Clathrate
- I-III
- AM
- AM₃₋₇
- II-IV
- II-III
- AM₂
- AM
- A₂M₅
- II-III-IV
- Zusammenfassung

| | | | | | | | | | | | | | | | | |
|--|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|
| | 1 | 2 | | | | | | | | | | | III | IV | V | |
| | I | II | | | | | | | | | | | 13 | 14 | 15 | |
| | Li | Be | | | | | | | | | | | Al | | | |
| | Na | Mg | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | |
| | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | | |
| | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | |
| | Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | |
| | Fr | Ra | Ac | Db | Jl | Rf | Bh | Hn | Mt | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr |

| | | | | | |
|----|----|----|----|----|----|
| Li | Na | K | Rb | Cs | Fr |
| Be | Mg | Ca | Sr | Ba | Ra |
| B | Al | Ga | In | Tl | |
| C | Si | Ge | Sn | Pb | |
| N | P | As | Sb | Bi | |
| O | S | Se | Te | Po | |
| F | Cl | Br | I | At | |
| Ne | Ar | Kr | Xe | Rn | |

PSE

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M₉-Cluster

Clathrate

I-III

AM

AM₃₋₇

II-IV

II-III

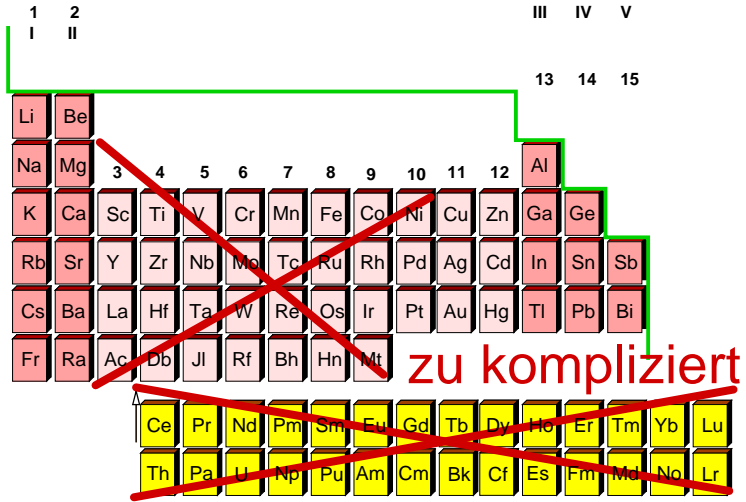
AM₂

AM

A₂M₅

II-III-IV

Zusammen-
fassung



| | | | |
|----|-----|----|----|
| Li | Ber | B | C |
| Na | Mg | Al | Si |
| K | Ca | Ga | Ge |
| Rb | Sr | In | Sn |
| Cs | Ba | Tl | Pb |

PSE

An der
Zintl-
Grenze

Einleitung

I-IV

AM

M_9 -Cluster

Clathrate

I-III

AM

AM_3 —7

II-IV

II-III

AM_2

AM

A_3M_5

II-III-IV

Zusammen-
fassung

| | | | | | | | | |
|--|----|----|--|-----|----|----|----|----|
| | 1 | 2 | | III | IV | V | | |
| | I | II | | | | | | |
| | | | | 13 | 14 | 15 | | |
| | Li | Be | | | | | | |
| | Na | Mg | | | | | | |
| | K | Ca | | 11 | 12 | Al | | |
| | Rb | Sr | | Cu | Zn | Ga | Ge | |
| | Cs | Ba | | Ag | Cd | In | Sn | Sb |
| | Fr | Ra | | Au | Hg | Tl | Pb | Bi |

| | | | |
|----|----|----|----|
| Li | Be | B | C |
| Na | Mg | Al | Si |
| K | Ca | Ga | Ge |
| Rb | Sr | In | Sn |
| Cs | Ba | Tl | Pb |

PSE

- An der Zintl-Grenze
- Einleitung
- I-IV
- AM
- M₉-Cluster
- Clathrate
- I-III
- AM
- AM₃₋₇
- II-IV
- II-III
- AM₂
- AM
- A₃M₅
- II-III-IV
- Zusammenfassung

