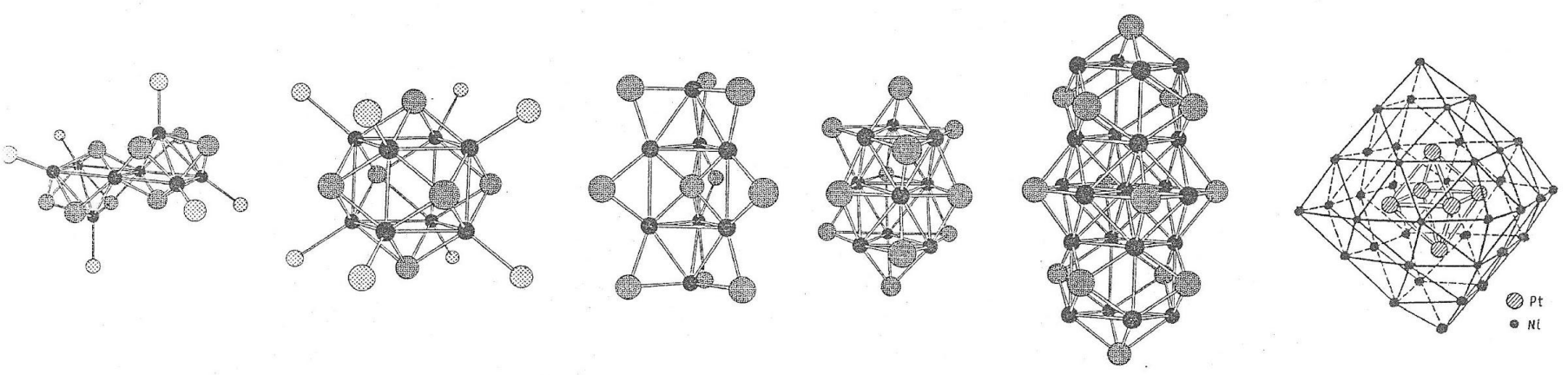
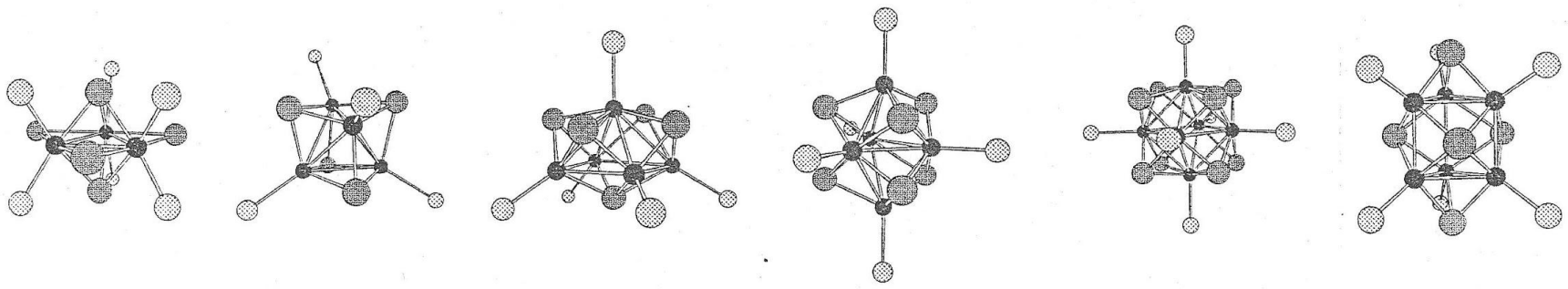
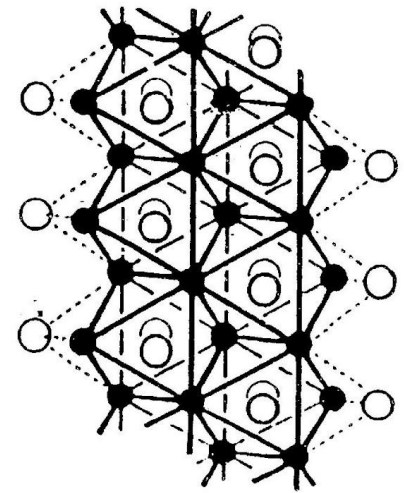
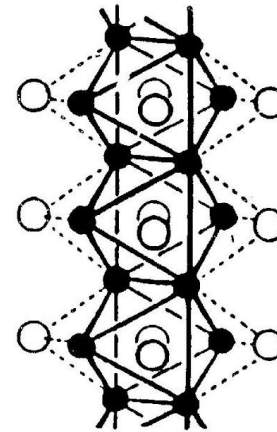
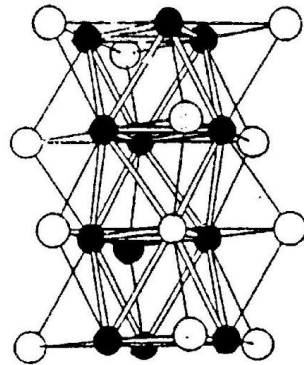
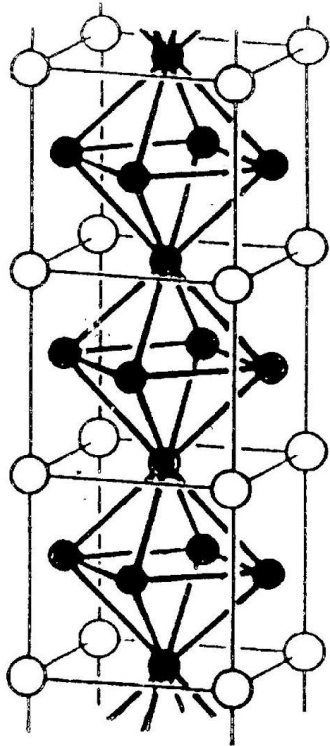


ГИГАНТСКИЕ КЛАСТЕРЫ

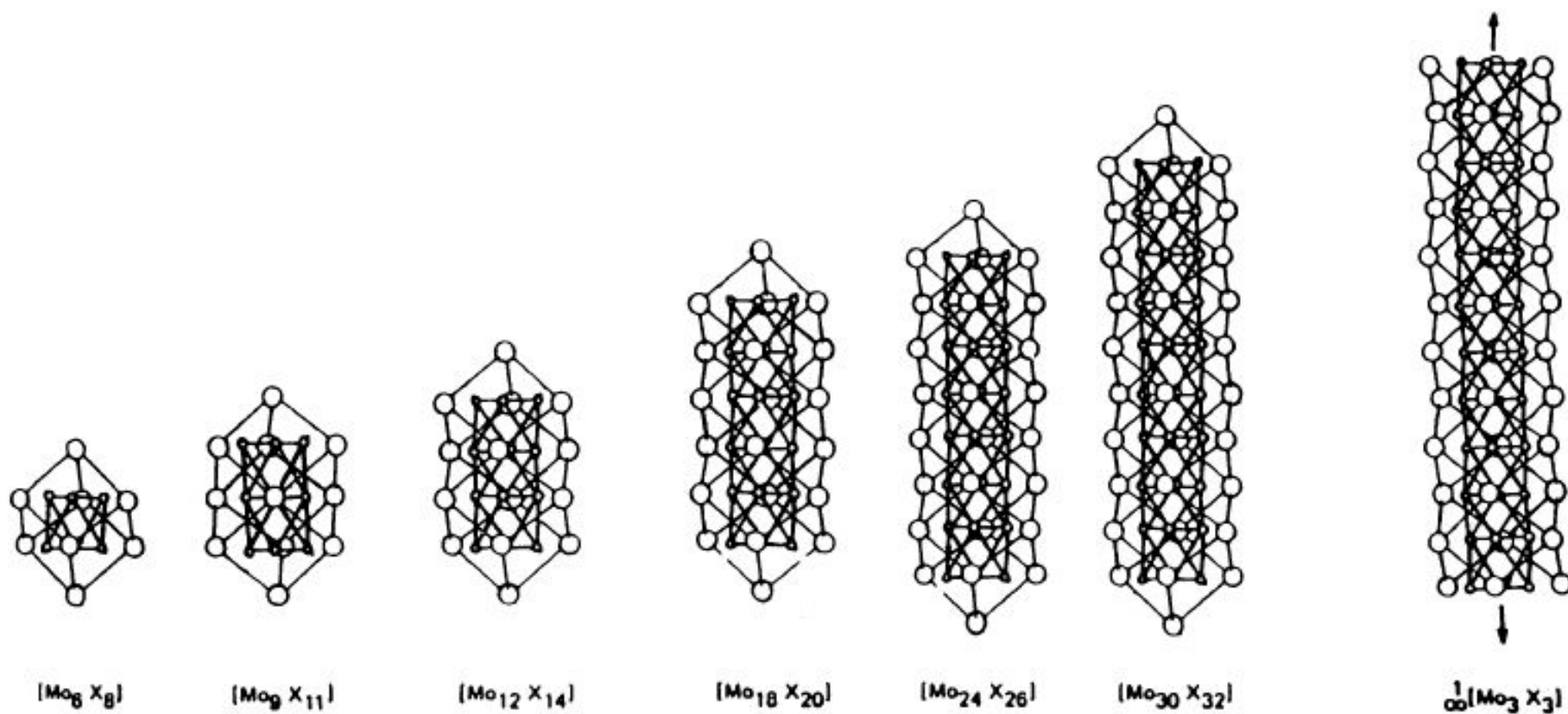


● Pt
● Ni

Примеры одномерной конденсации октаэдрических металлокластеров

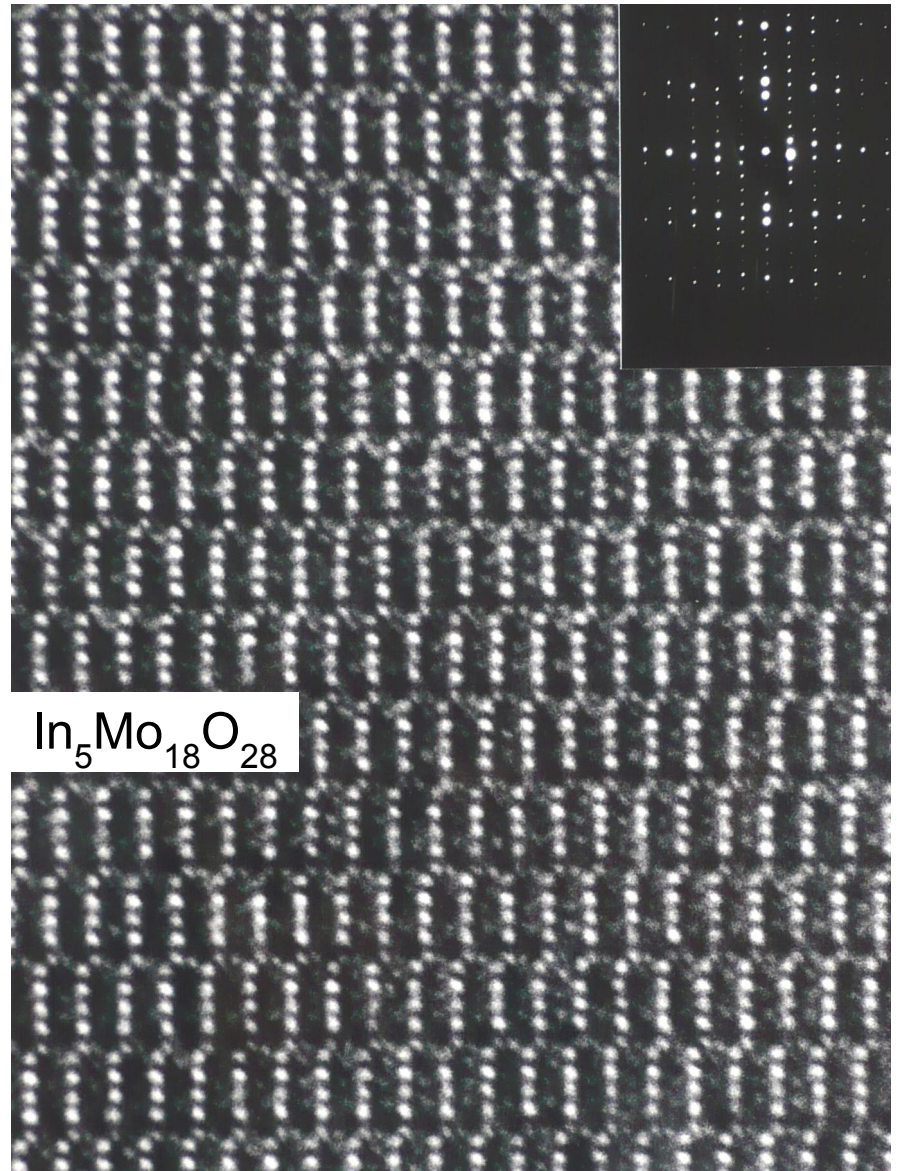
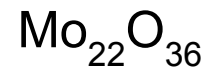
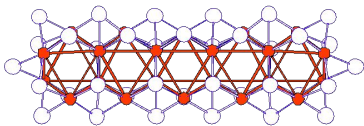
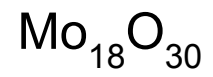
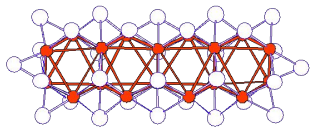
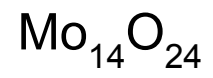
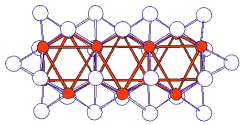
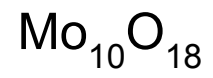
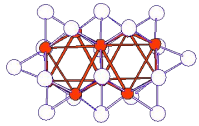
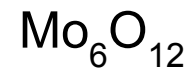
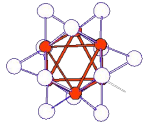


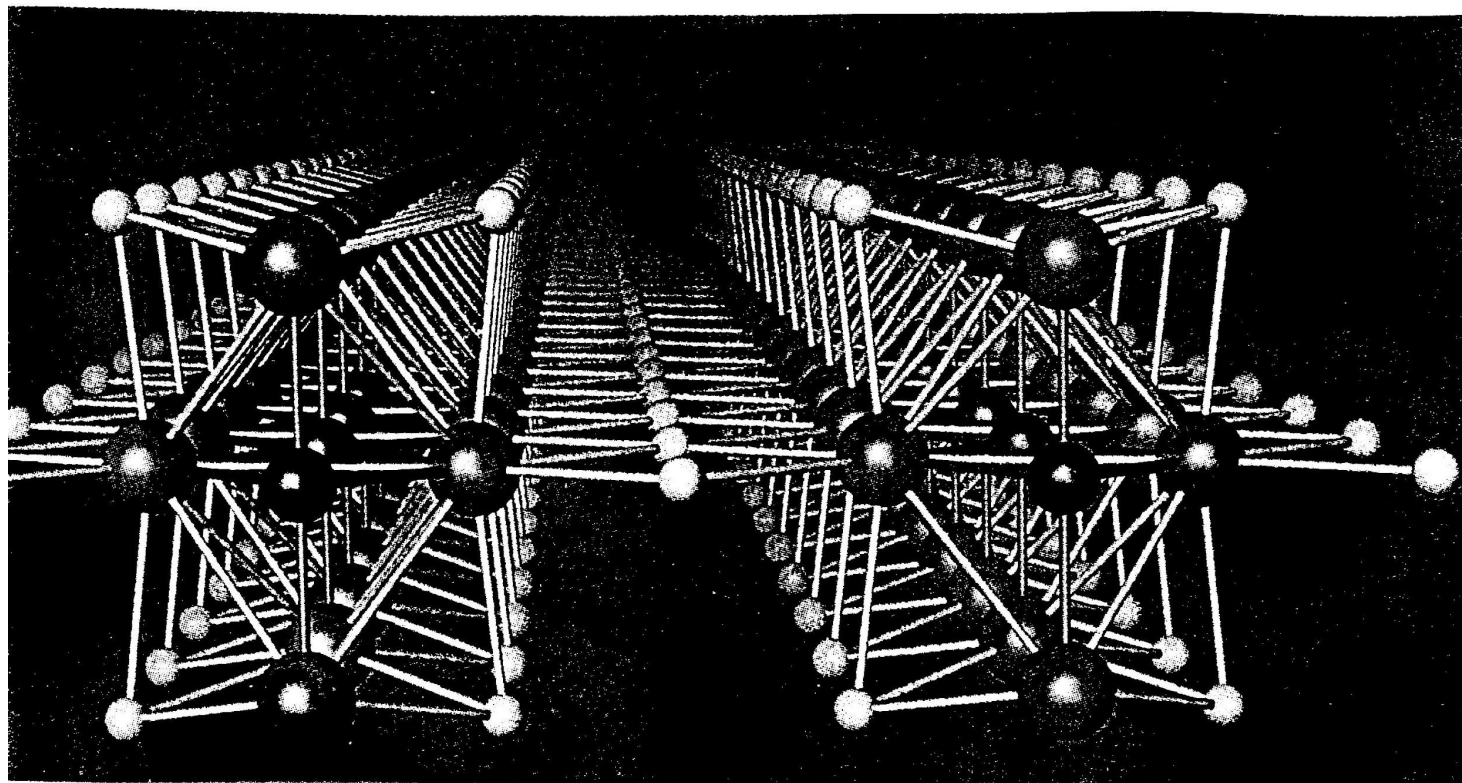
Прогрессивная одномерная конденсация октаэдрических кластеров молибдена



Oxomolybdates

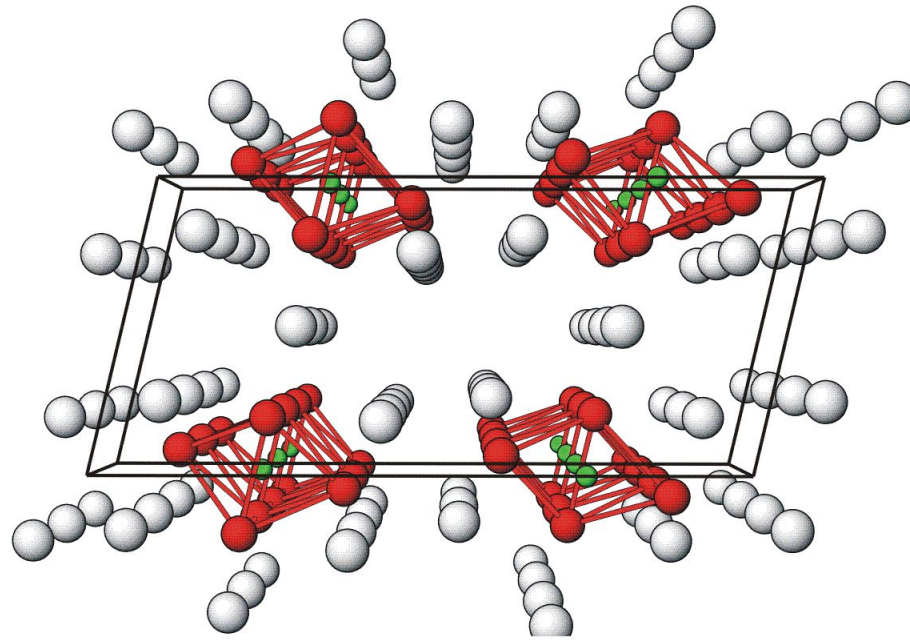
Cluster



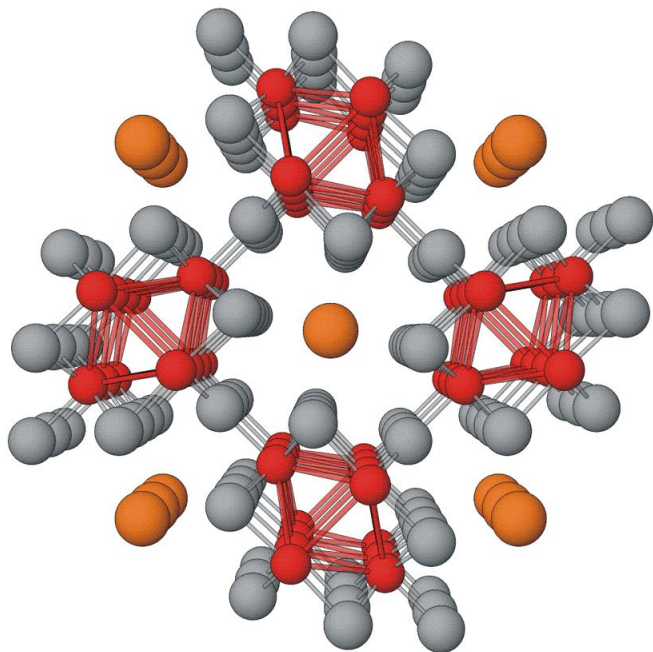


Связывание металлокластерных цепочек в слой
через *транс*-мостиковые атомы иода

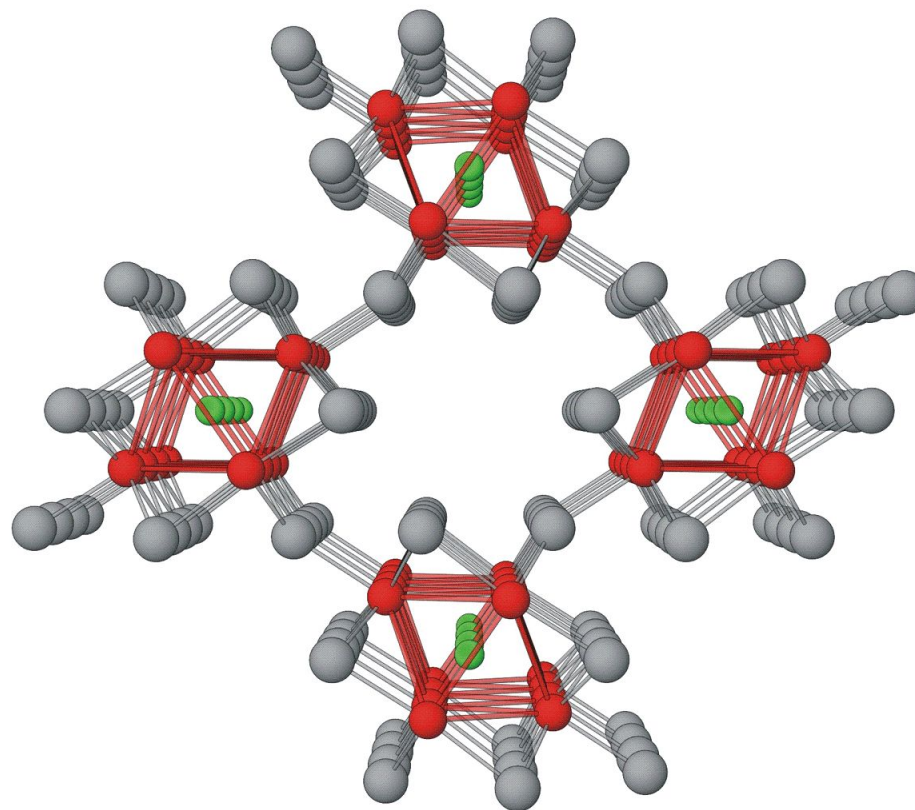
Chains



Chains of Octahedra



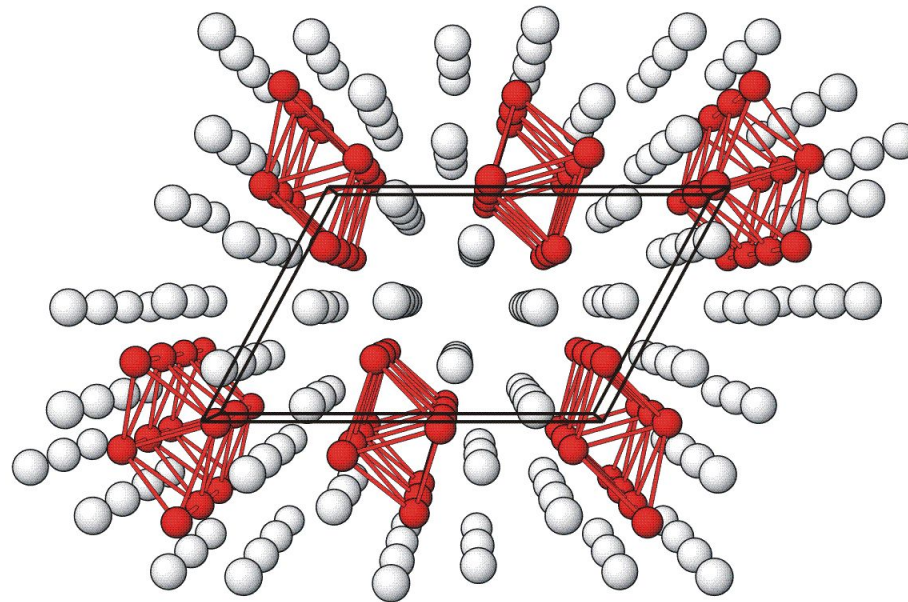
NaMo_4O_6



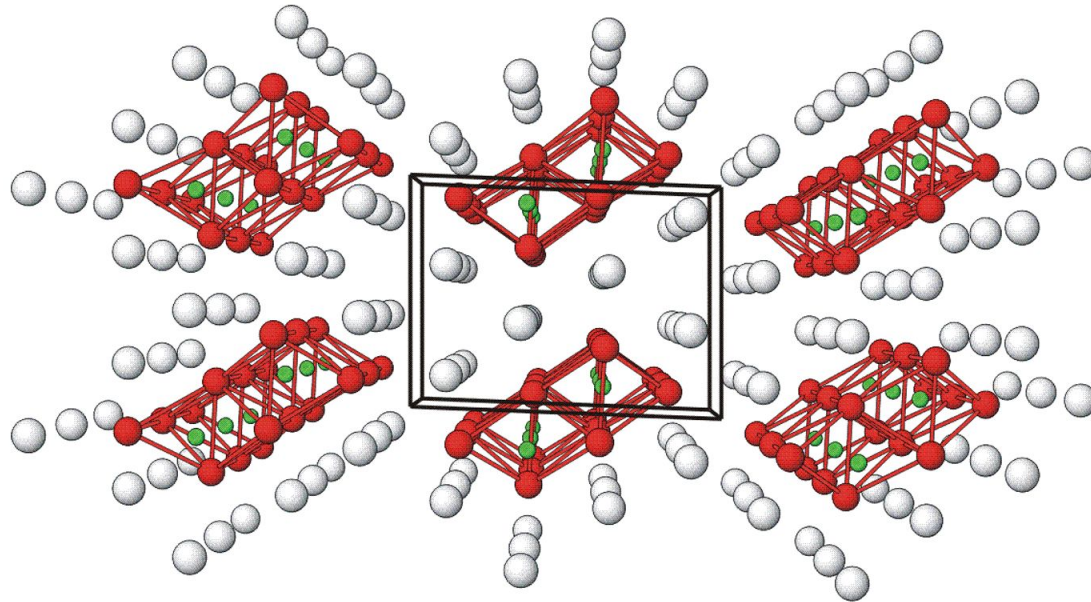
$\text{Gd}_4\text{Br}_6\text{Si}$

**Связывание металлокластерных цепочек
через *цис*-мостиковые лиганды**

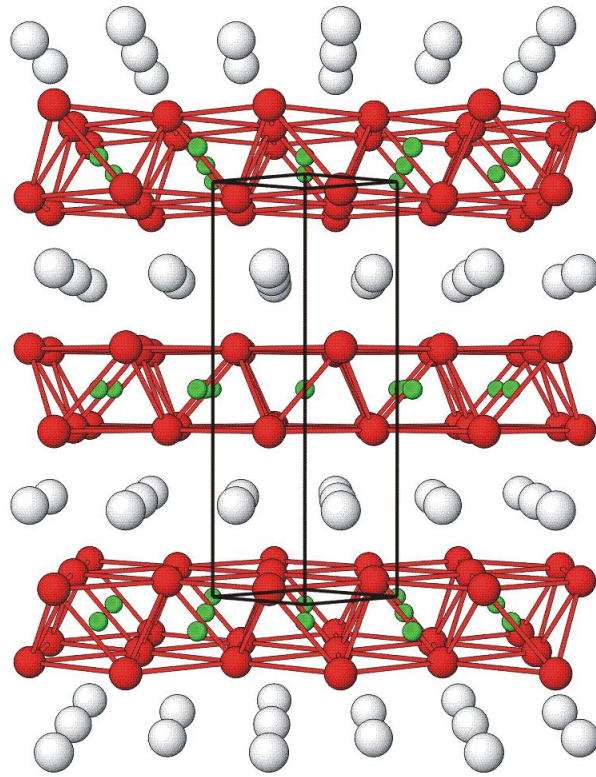
Chains



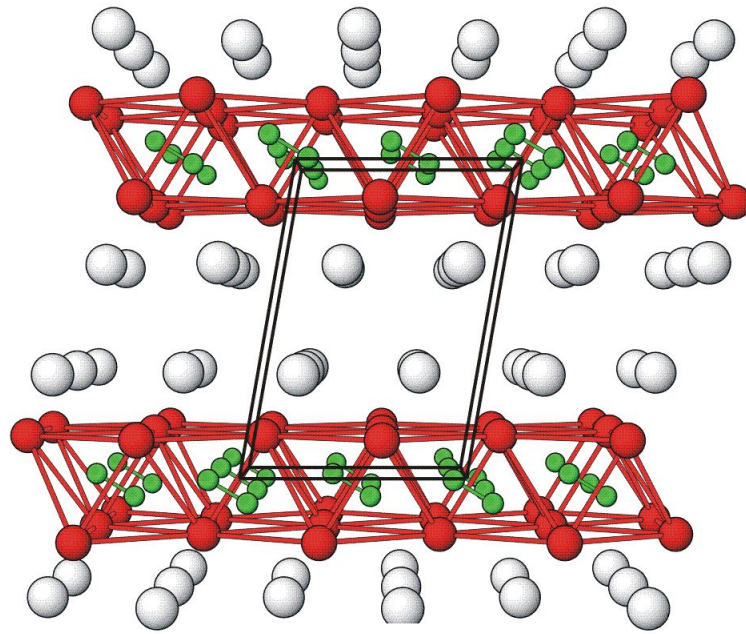
Twin-Chains



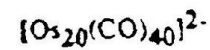
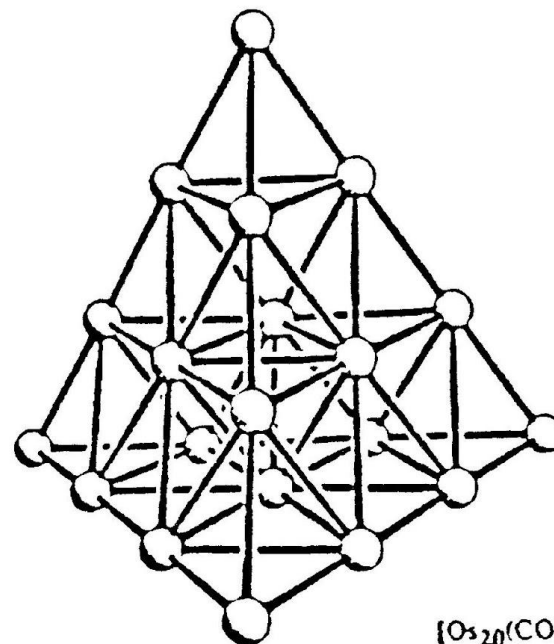
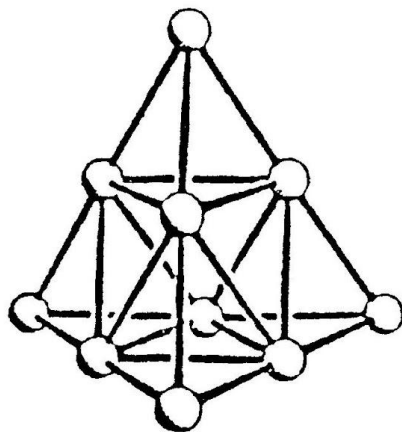
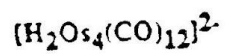
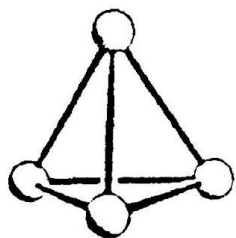
Layers



Layers



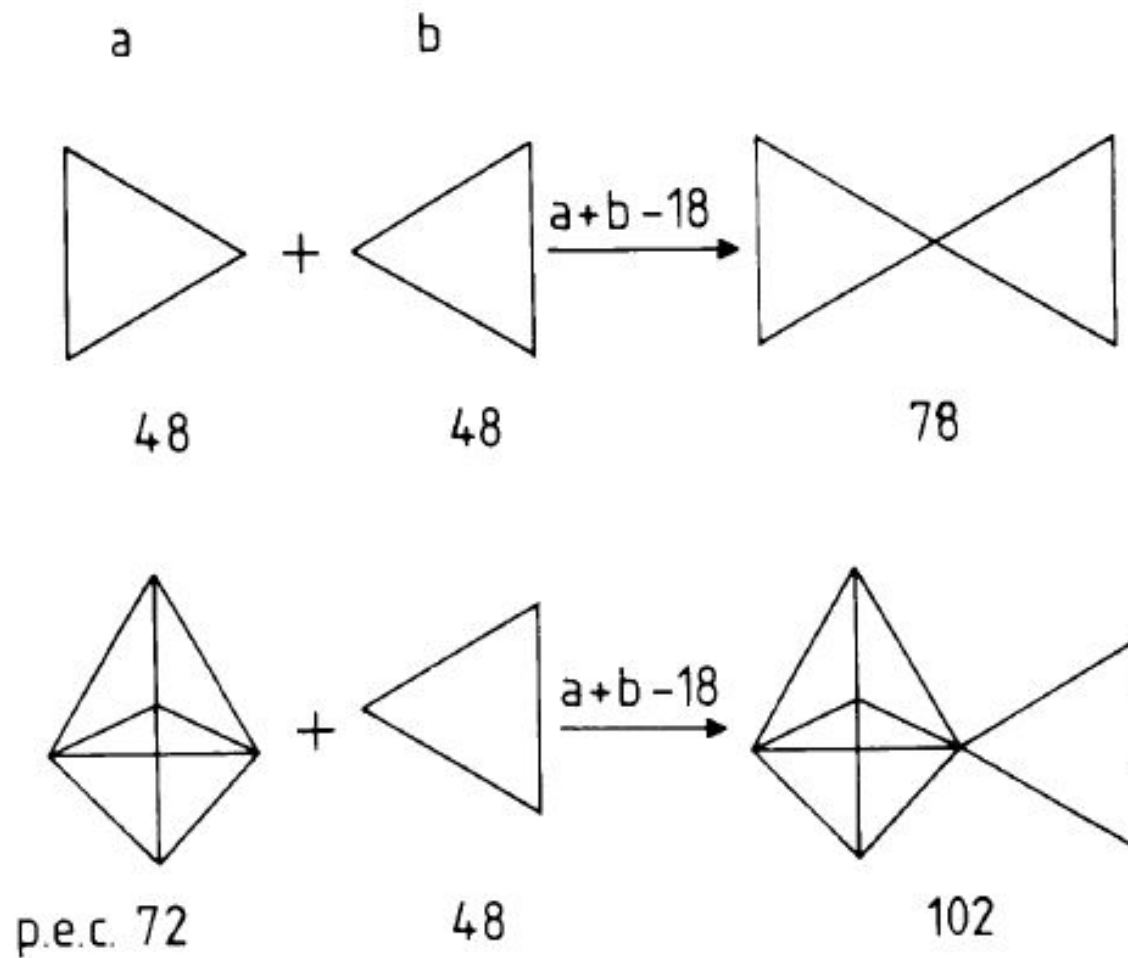
Конденсация тетраэдрических металлокластеров



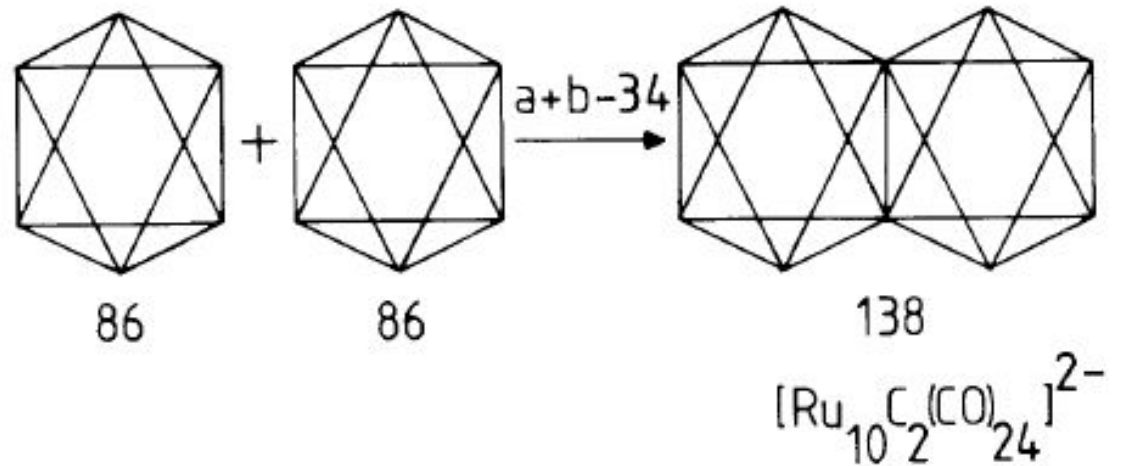
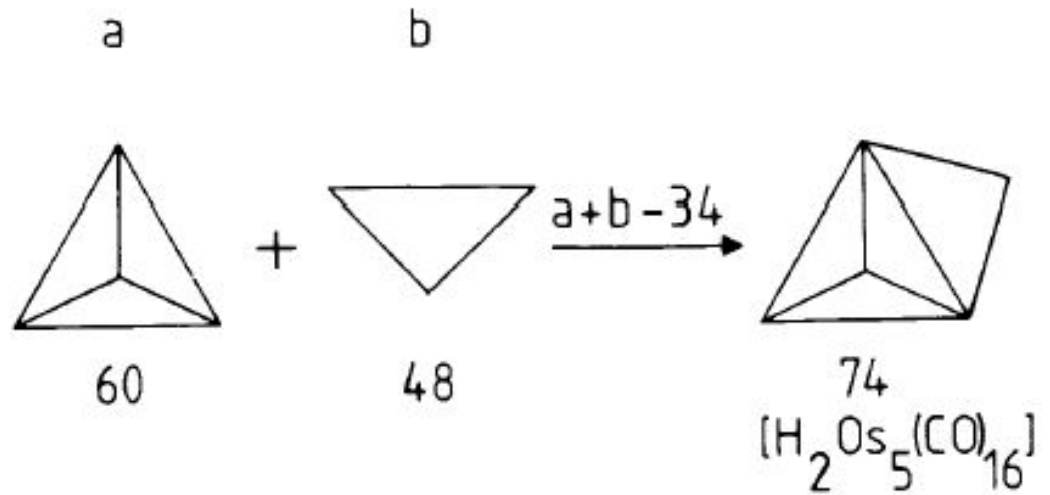
Правило подсчета числа электронов для конденсированных кластеров:

число кластерных валентных электронов (КВЭ) конденсированных кластеров равно сумме КВЭ исходных полиэдров минус число электронов атома, лежащего в общей вершине (18e), пары атомов в общем ребре (34e) или граневых атомов, общих для обоих полэдров (48e для общего треугольника, 62 для общего квадрата)

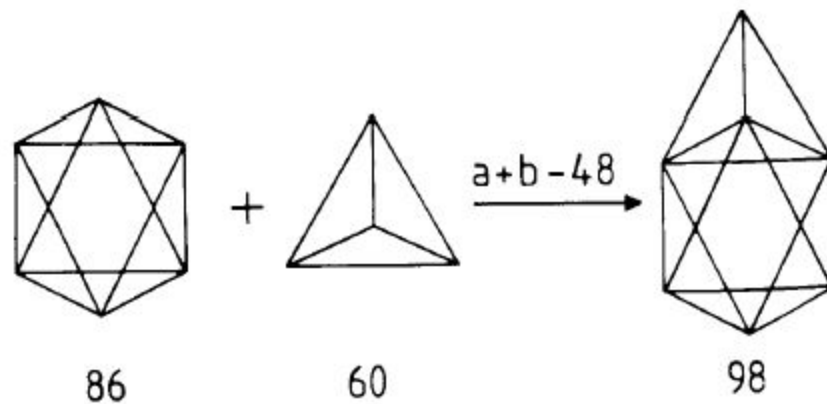
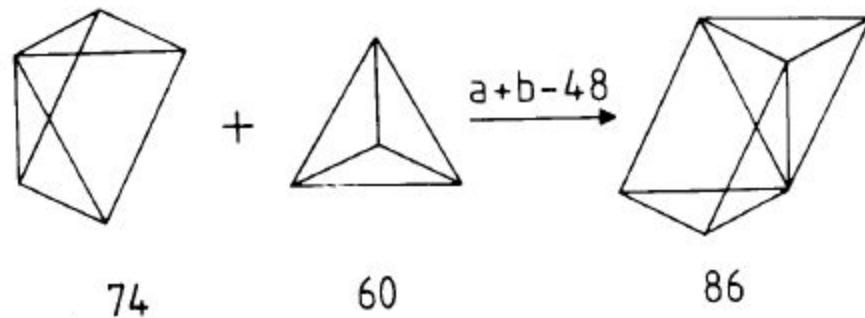
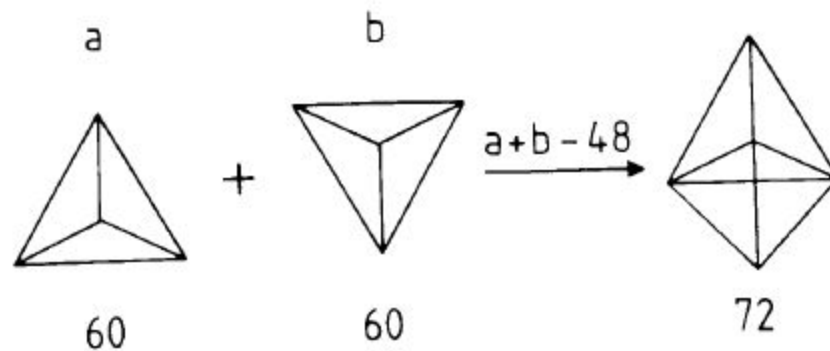
Конденсация металлокластеров через общую вершину

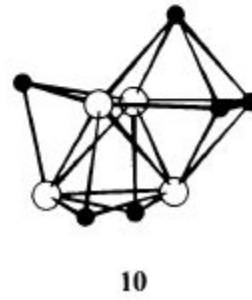
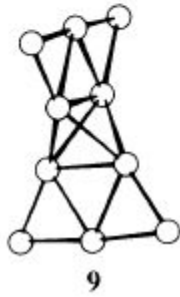
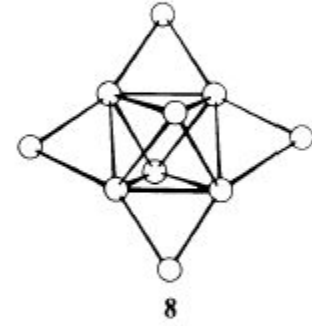
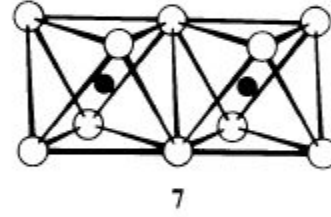
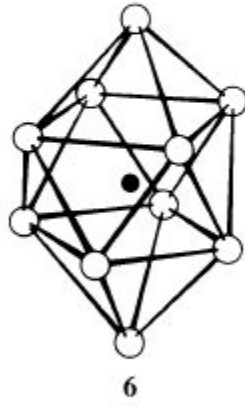
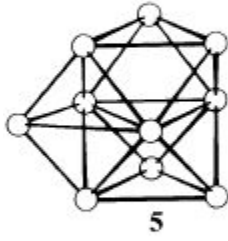
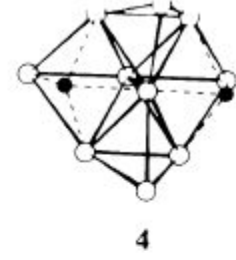
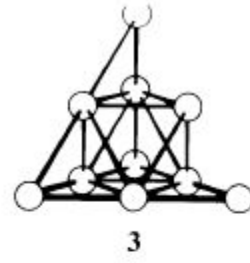
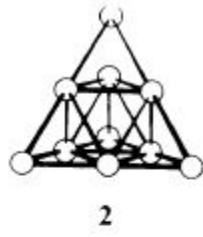
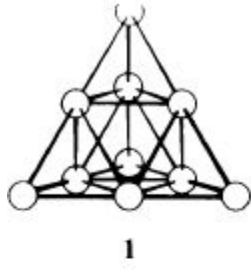


**Конденсация
металлокластеров
через общее ребро**

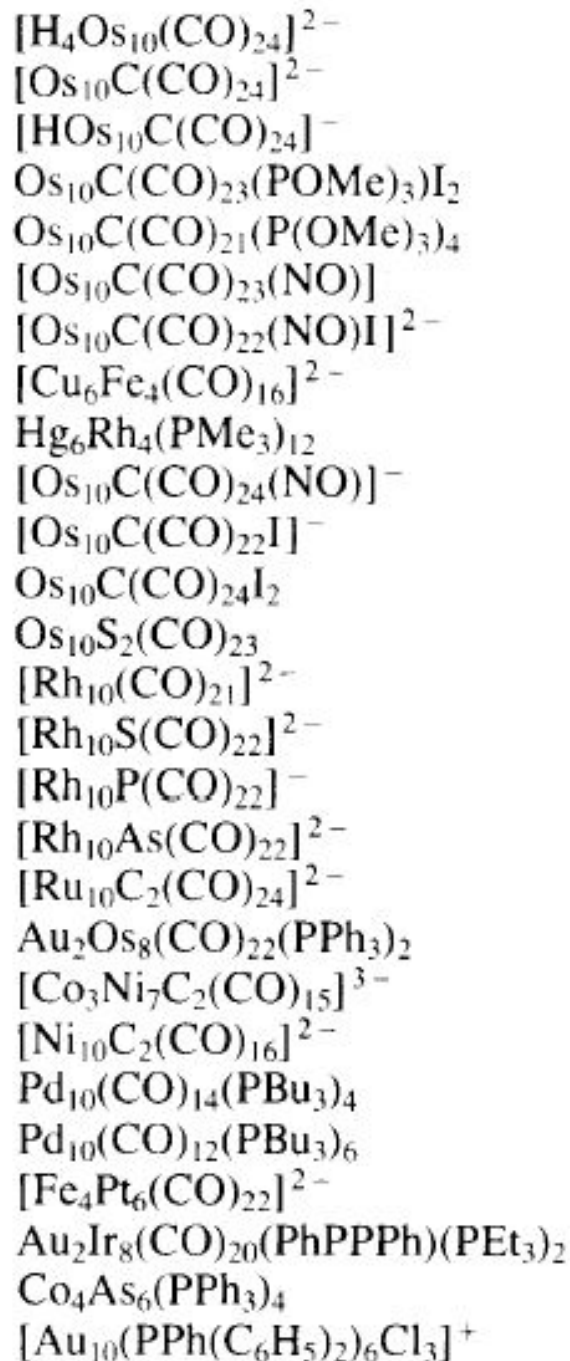


**Конденсация
металлокластеров
через общую
треугольную грань**

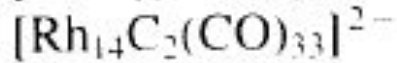
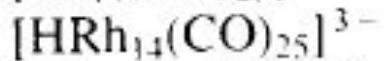
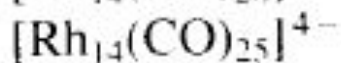
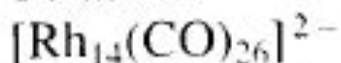




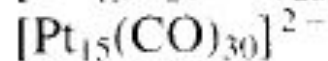
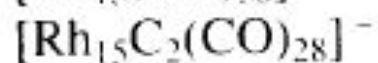
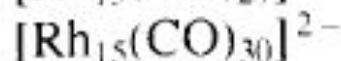
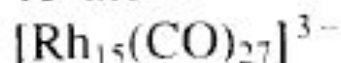
10-ядерные металлокластеры



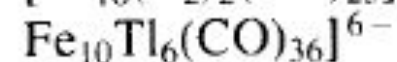
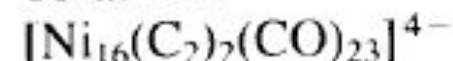
14 atoms



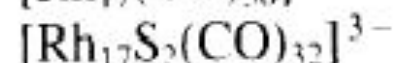
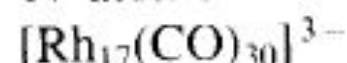
15 atoms



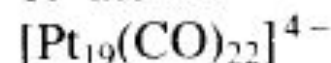
16 atoms



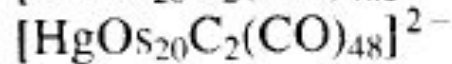
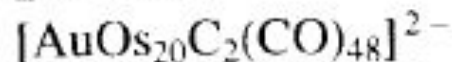
17 atoms



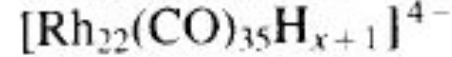
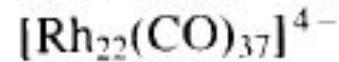
19 atoms



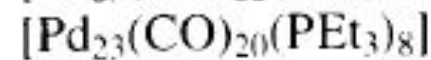
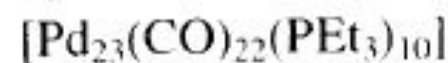
21 atoms



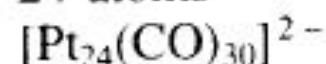
22 atoms



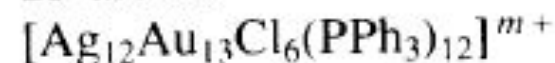
23 atoms



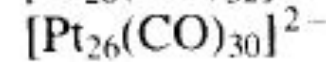
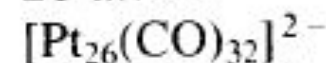
24 atoms



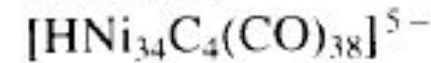
25 atoms



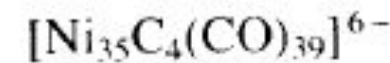
26 atoms

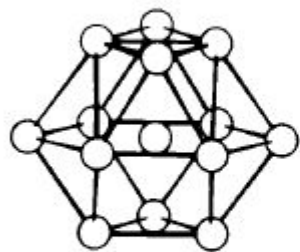


34 atoms



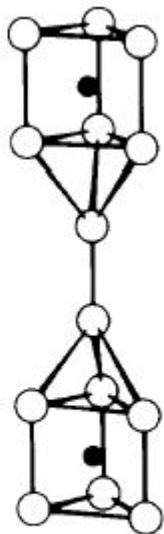
35 atoms





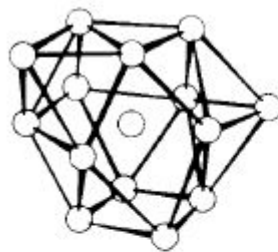
1

Rh₁₄

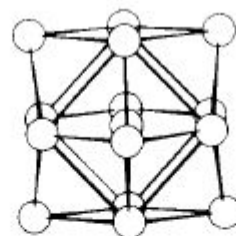


2

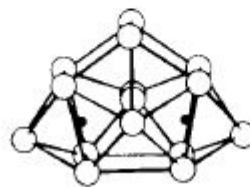
M₁₅



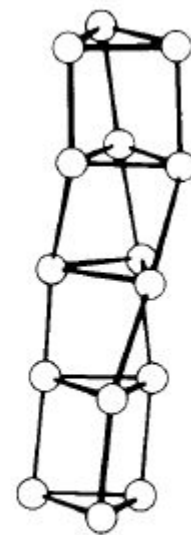
1



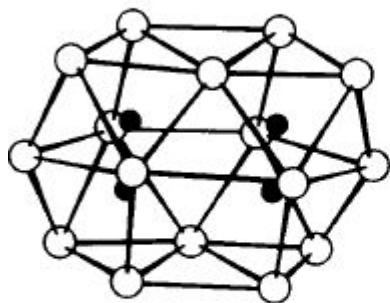
2



3

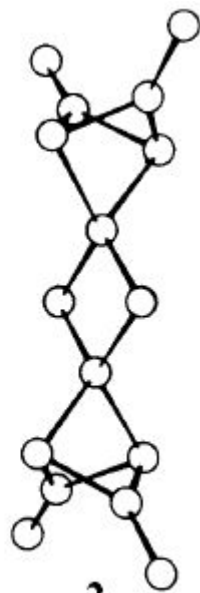


4



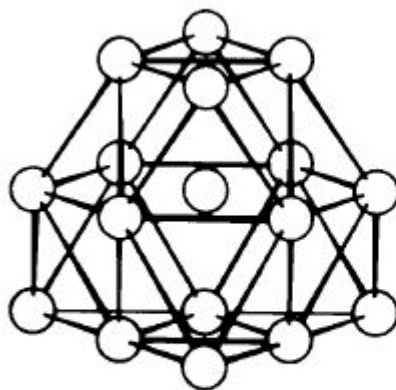
1

M₁₆

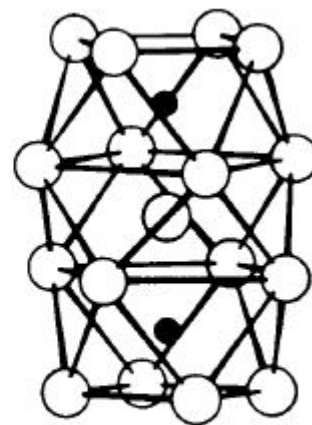


2

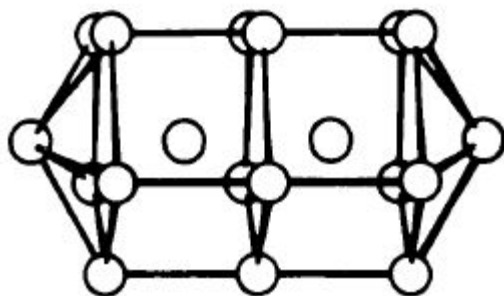
Rh₁₇



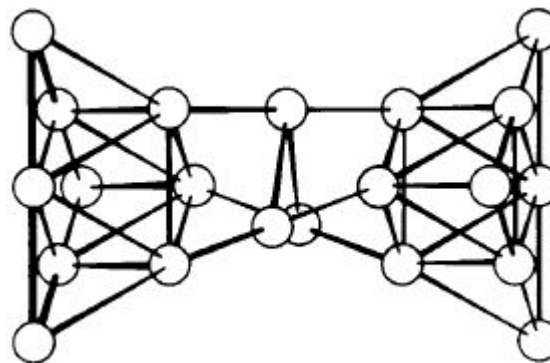
1



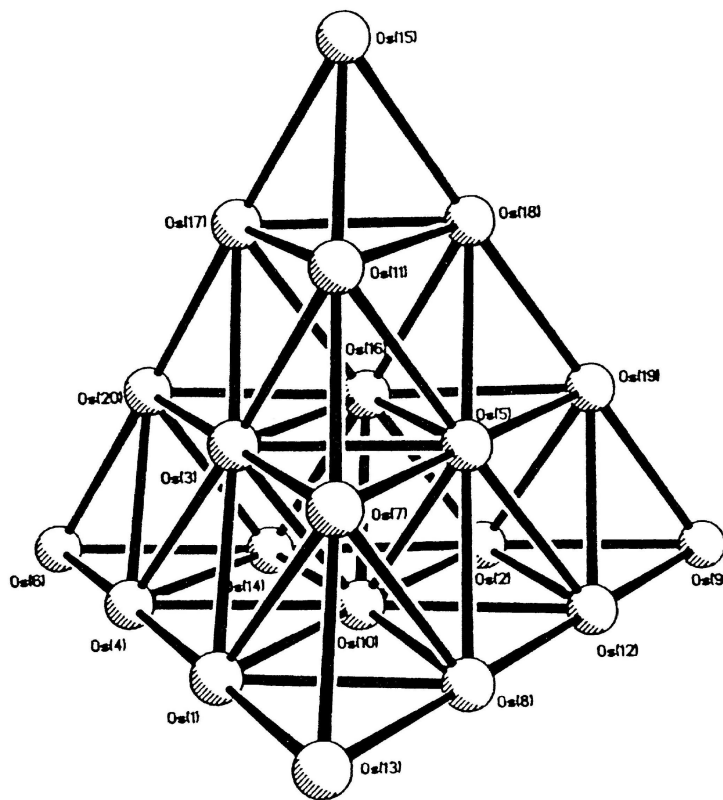
2

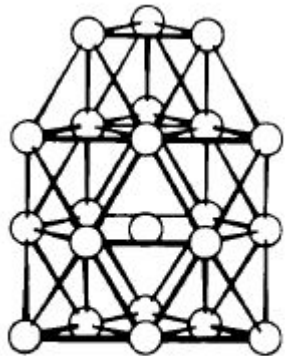


Pt₁₉



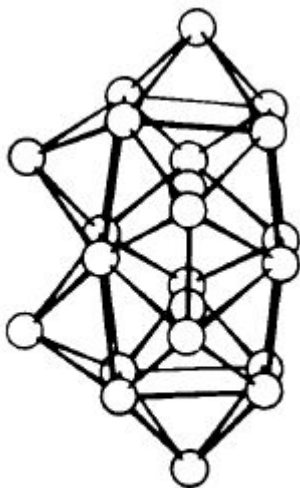
Os₂₀M (M=Au, Hg)



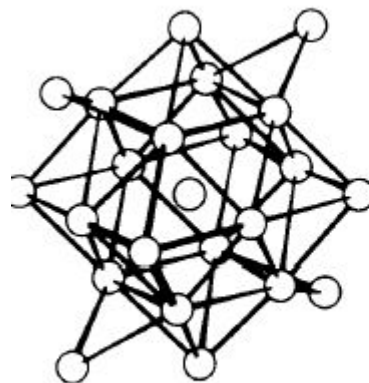


1

Rh₂₂

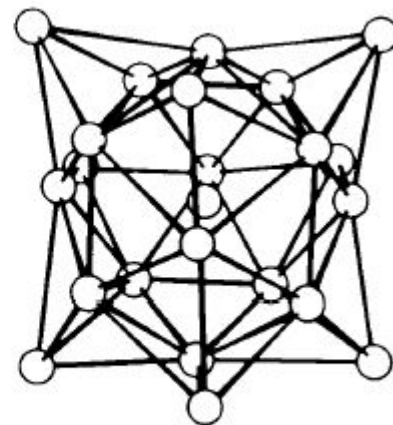


2

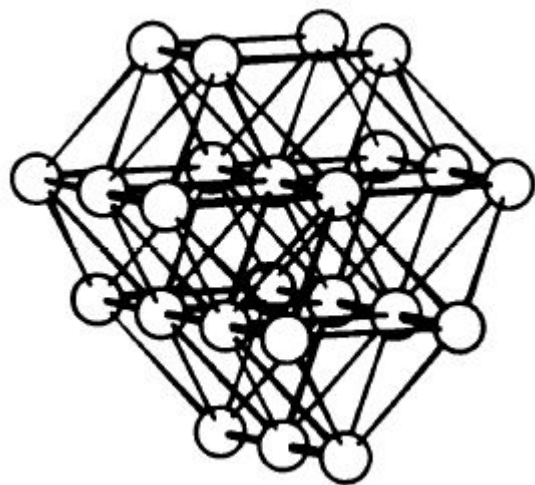


1

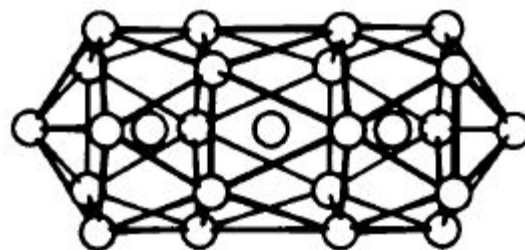
Pd₂₃



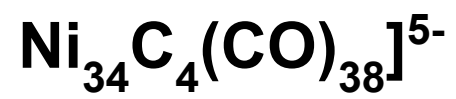
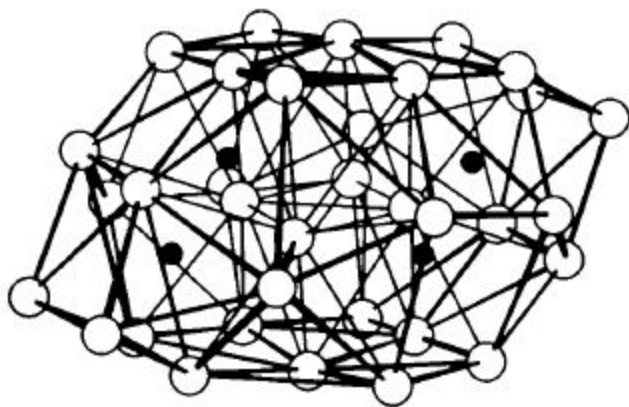
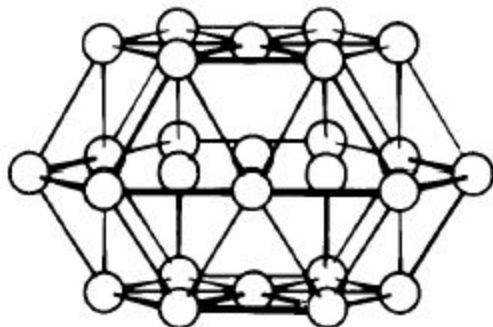
2

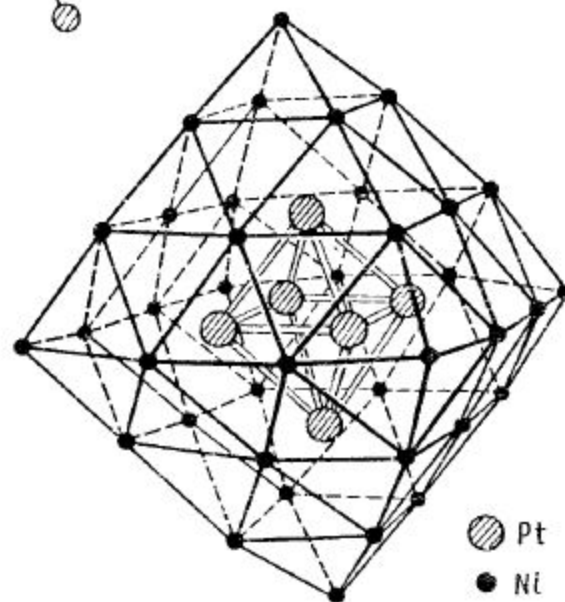
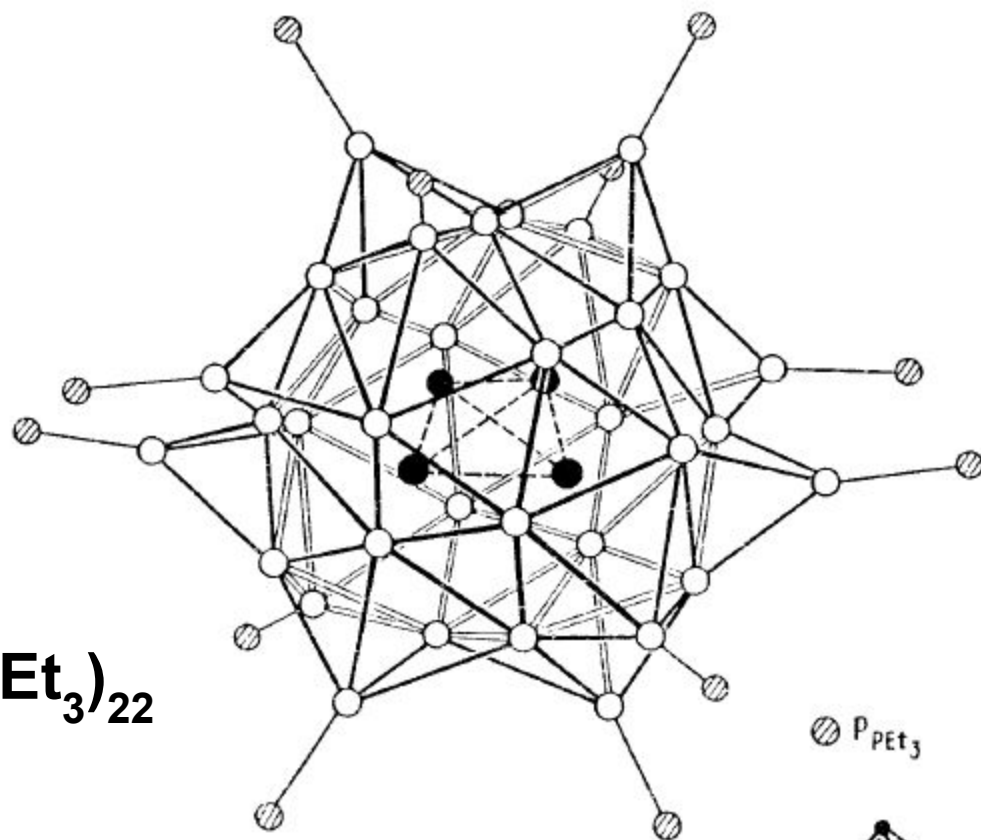


Pt₂₄

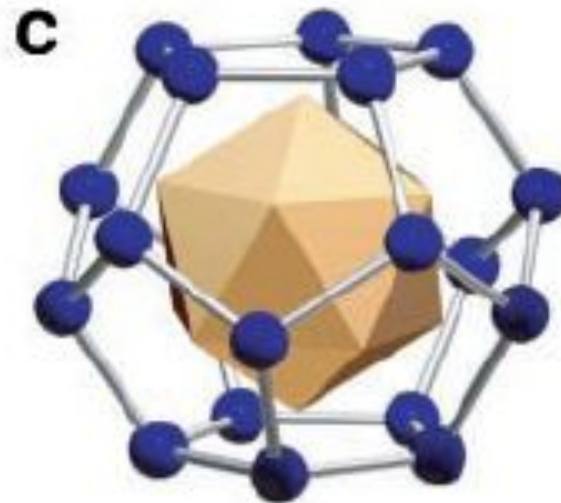
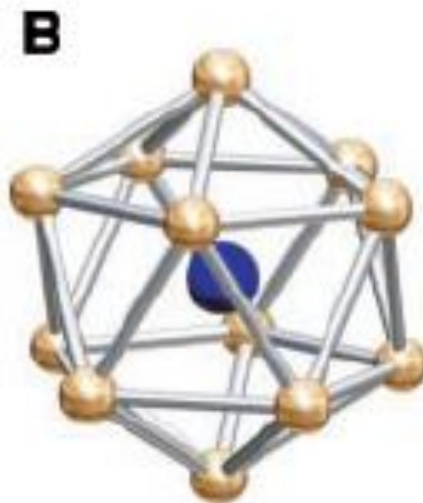
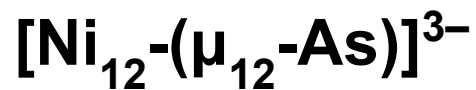
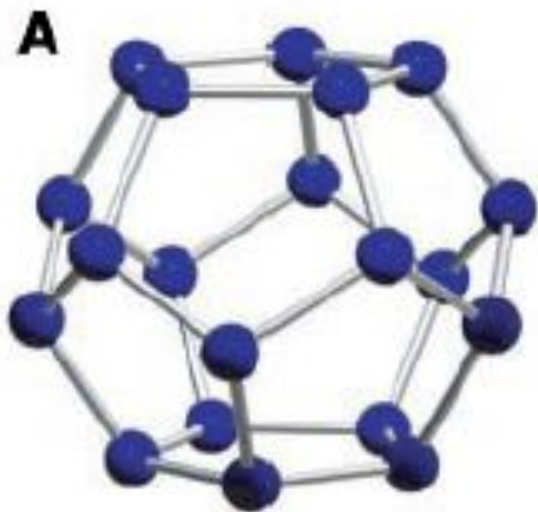


Ag₁₂Au₁₃





M.J. Moses, J.C. Fettinger, B.W. Eichhorn,
Interpenetrating As_{20} Fullerene and Ni_{12} Icosahedra in the Onion-Skin
 $[\text{As}@\text{Ni}_{12}@\text{As}_{20}]^{3-}$ Ion,
SCIENCE VOL 300 2 MAY 2003



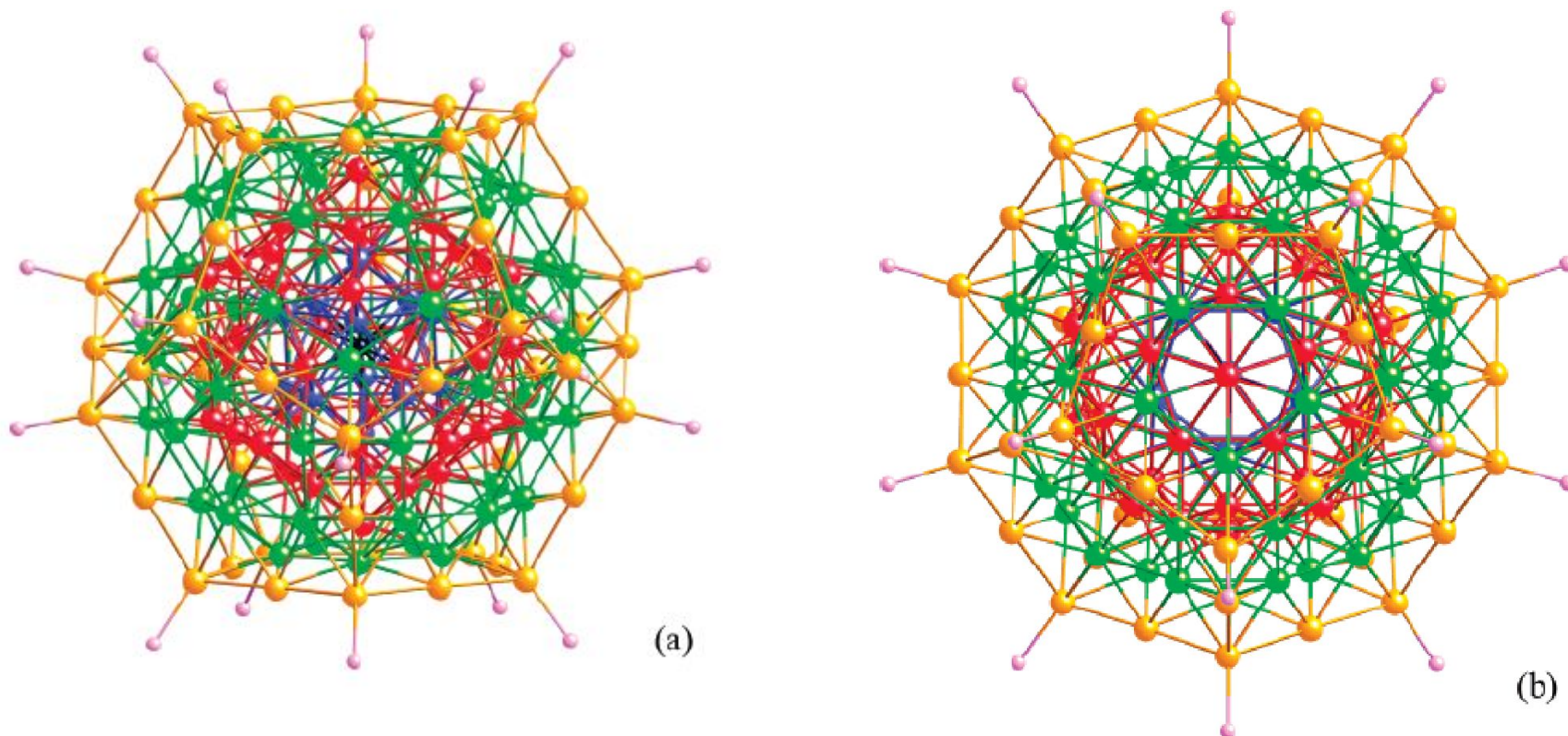
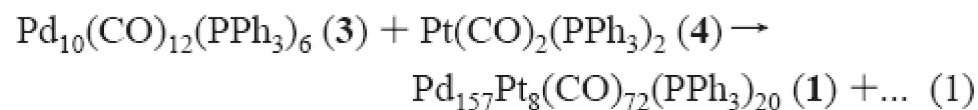


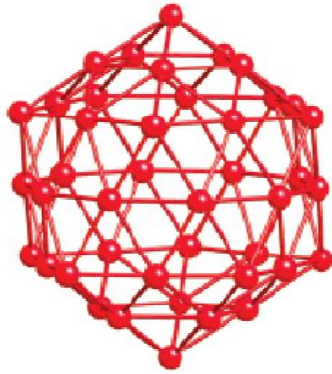
Figure 1. Side/top views of $(\mu_{12}\text{-Pt})\text{Pd}_{164-x}\text{Pt}_x(\text{CO})_{72}\text{P}_{20}$ fragment in Pt-centered four-shell 165-atom Pd–Pt cluster, $(\mu_{12}\text{-Pt})\text{Pd}_{164-x}\text{Pt}_x(\text{CO})_{72}(\text{PPh}_3)_{20}$ ($x \approx 7$), of pseudo icosahedral I_h ($2/m\bar{3}5$) and cubic crystallographic T_h



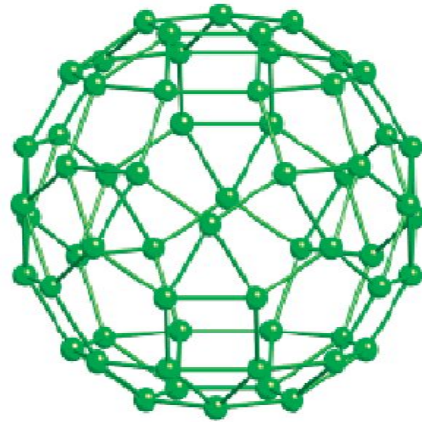
Evgueni G. Mednikov,^{*,†} Matthew C. Jewell,[‡] and Lawrence F. Dahl^{*,†}



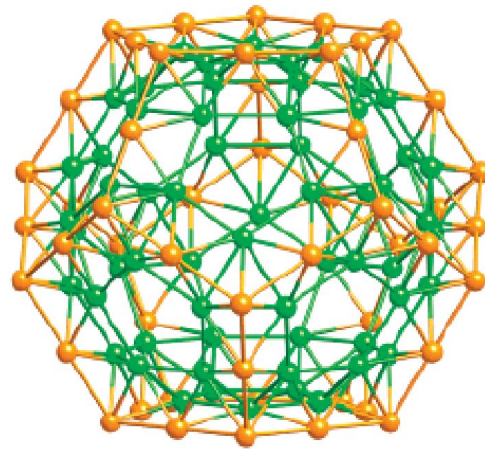
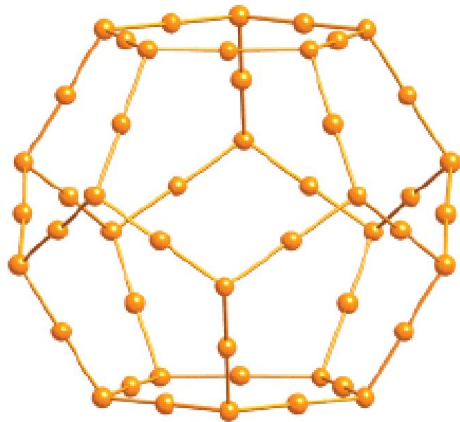
(a)



(b)



(c)



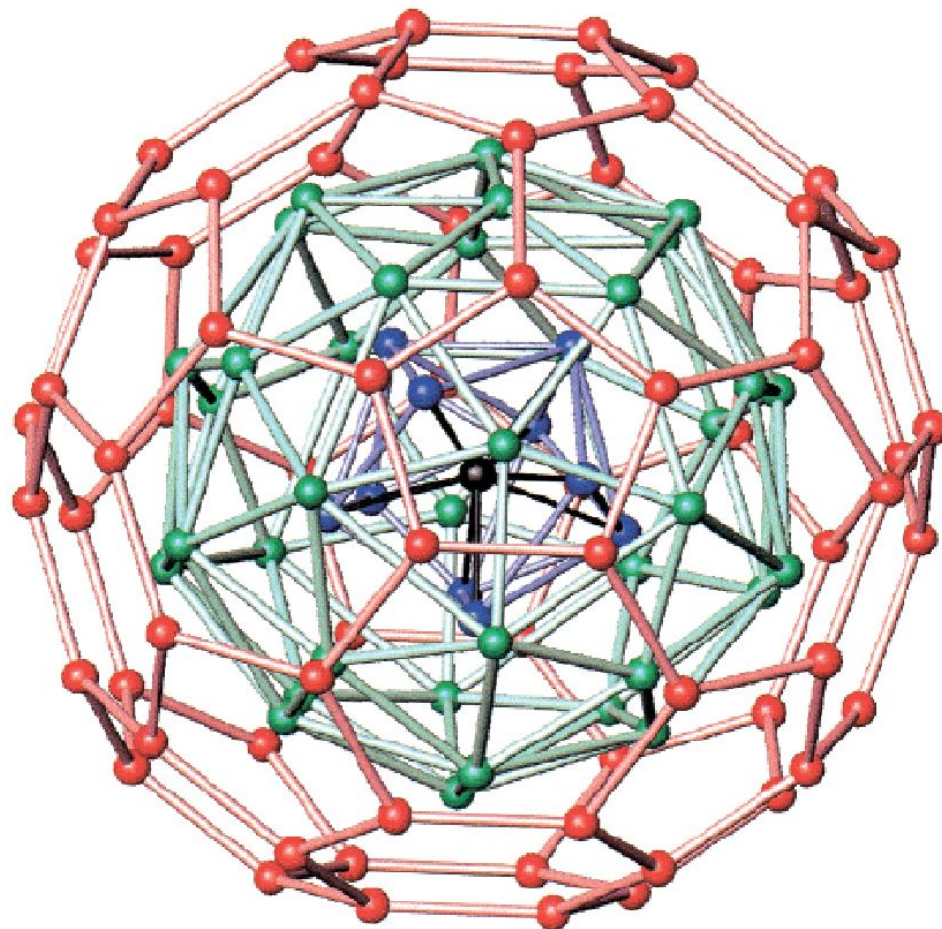
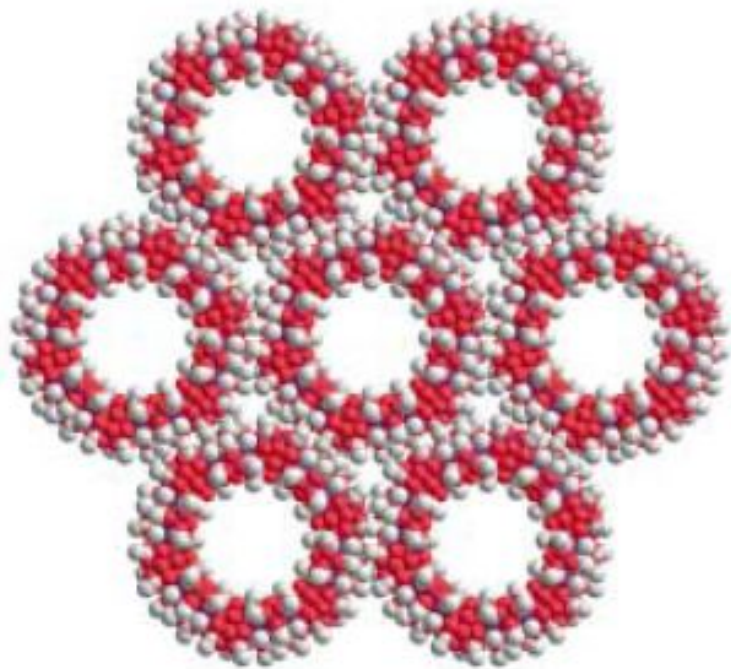
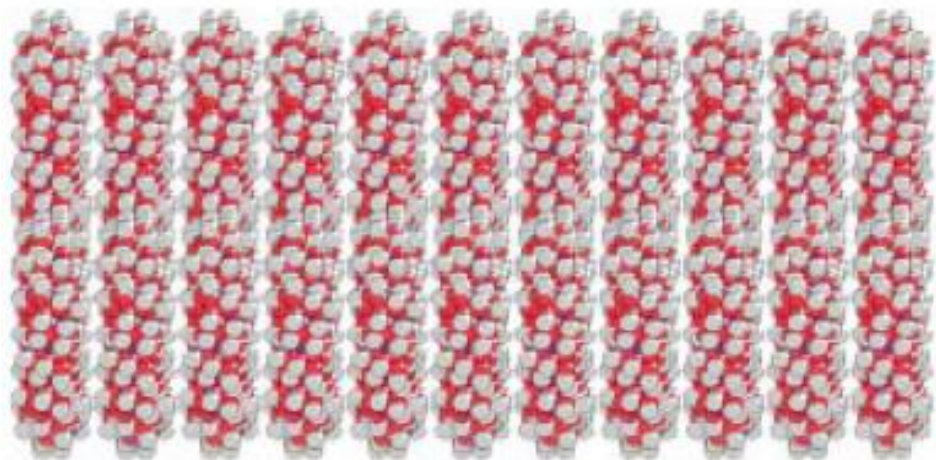
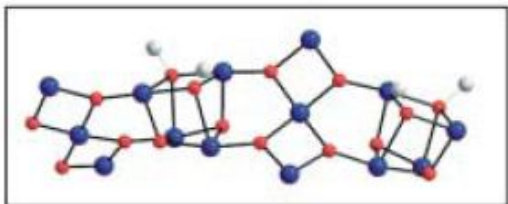


Figure 14. The multiply-endohedral $\text{Ni}@_{\text{In}_{10}}@_{\text{Ni}_{37}}@_{\text{In}_{70}}$ cluster extracted from the structure of $\text{Na}_{172}\text{In}_{197}\text{Ni}_2$ with atoms in this sequence colored black, blue, green, and red, respectively. Each Na lies below the center of each pentagonal or hexagonal face of the In_{70} fullerene, but interconnections within the green Na_{37} polyhedron are meant only to guide the eye.

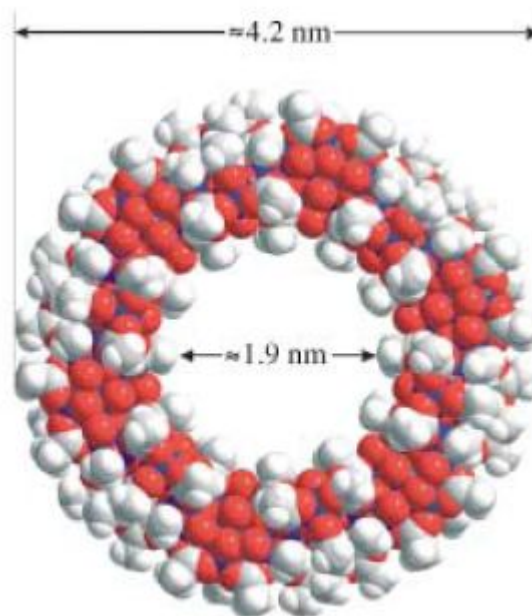
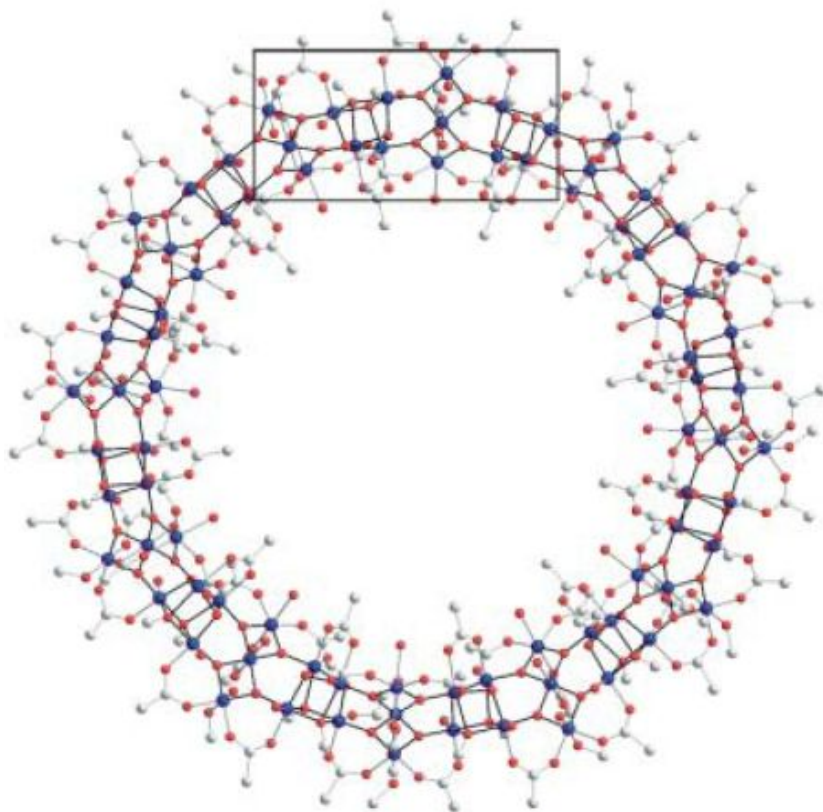
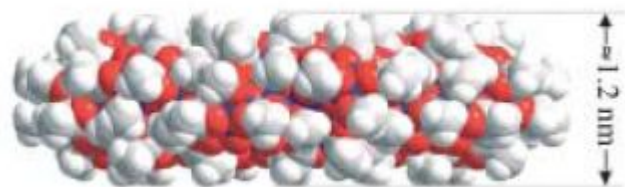


**A.J. Tasiopoulos, A. Vinslava,
W. Wernsdorfer, K.A. Abboud,
G. Christou,
Giant Single-Molecule Magnets:
A {Mn₈₄} Torus and Its
Supramolecular Nanotubes,
Angew. Chem. Int. Ed. 2004, 43,
2117 –2121**

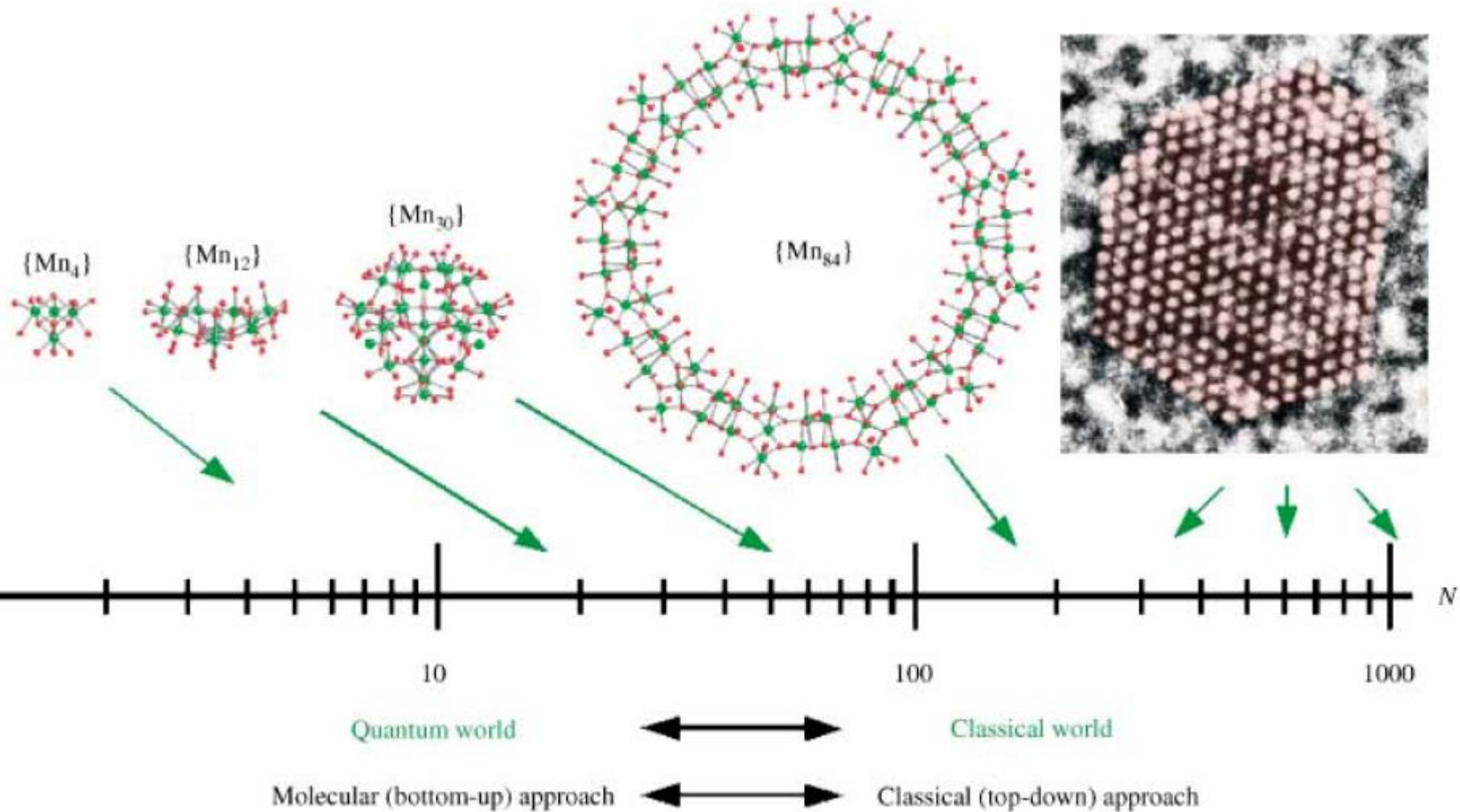
Near-linear $[\text{Mn}_3\text{O}_4]$ and
cubic $[\text{Mn}_4\text{O}_2(\text{OMe})_2]$ subunits



Single-molecule magnets (SMMs)



A.J. Tasiopoulos, A. Vinslava, W. Wernsdorfer, K.A. Abboud, G. Christou,
 Single-Molecule Magnets: A $\{Mn_{84}\}$ Torus and Its Supramolecular Nanotubes,
Chem. Int. Ed. 2004, 43, 2117–2121



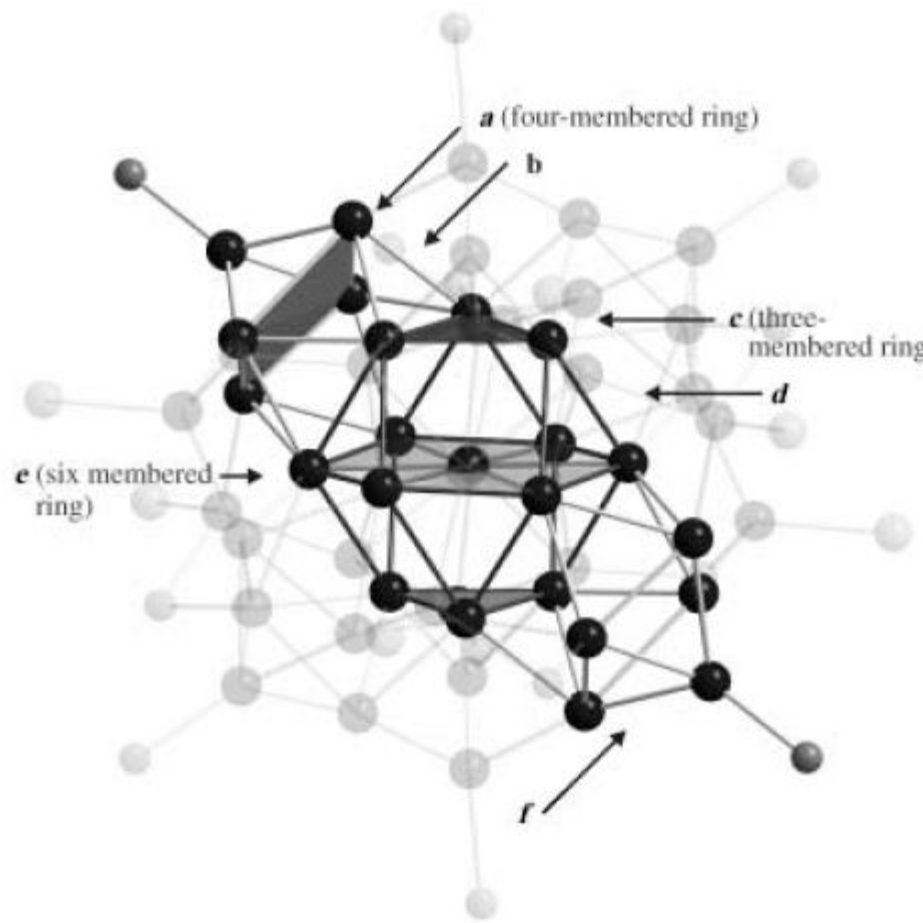
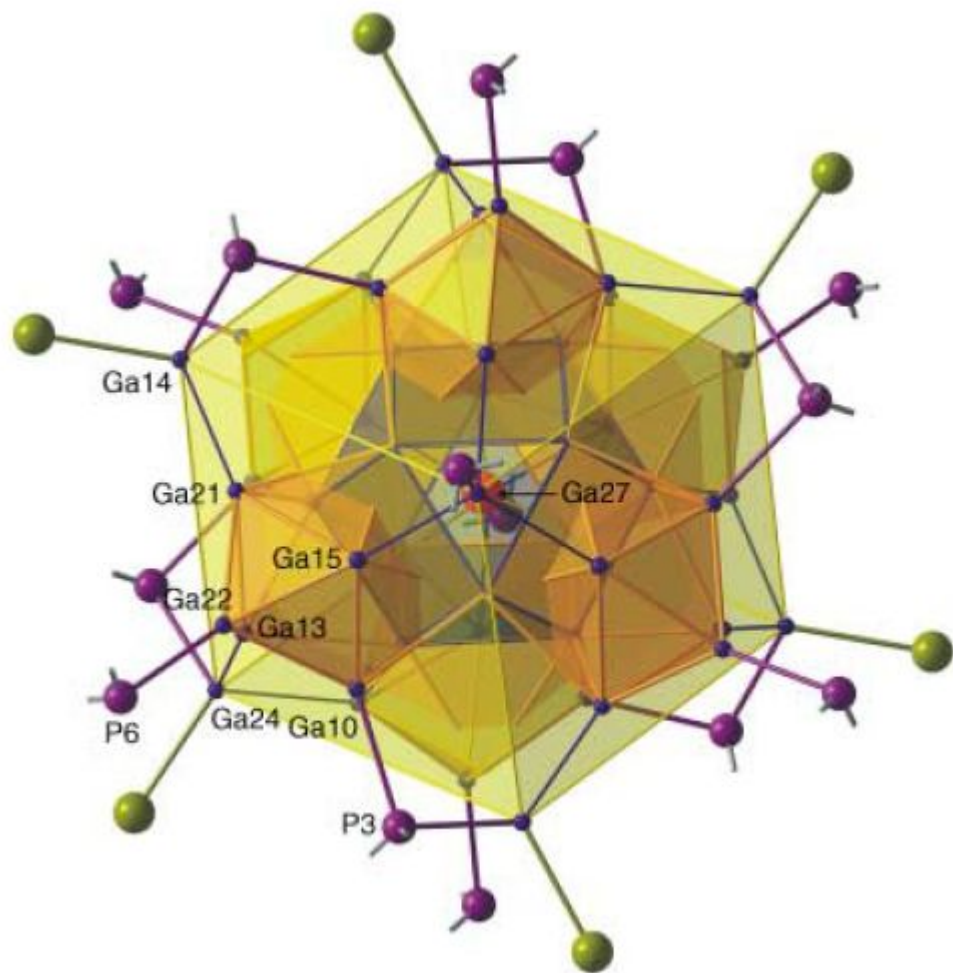


Figure 2. To illustrate the variance of the Ga–Ga distances, a cross-section of **1 a** is highlighted (see text). The following distances [pm] are observed: *a* 259.5–295.8, *b* 258.9–278.4, *c* 284.8–286.2, *d* 279.3–295.3, *e* 275.8–278.8, *f* 245.5–268.1.

J. Steiner, G. Stößer, H. Schnöckel,
[Ga₅₁(PtBu₂)₁₄Br₆]³⁻: An Elementoid Gallium Cluster with Metalloid and Nonmetalloid Structural Elements,
Angew. Chem. Int. Ed. 2004, 43, 302–305

N.T. Tran, D.R. Powell, L.F. Dahl,

Nanosized Pd₁₄₅(CO)_x(PEt₃)₃₀ Containing a Capped Three-Shell 145-Atom Metal-Core Geometry of Pseudo Icosahedral Symmetry

Angew. Chem. Int. Ed. 2000, 39, 4121–4125

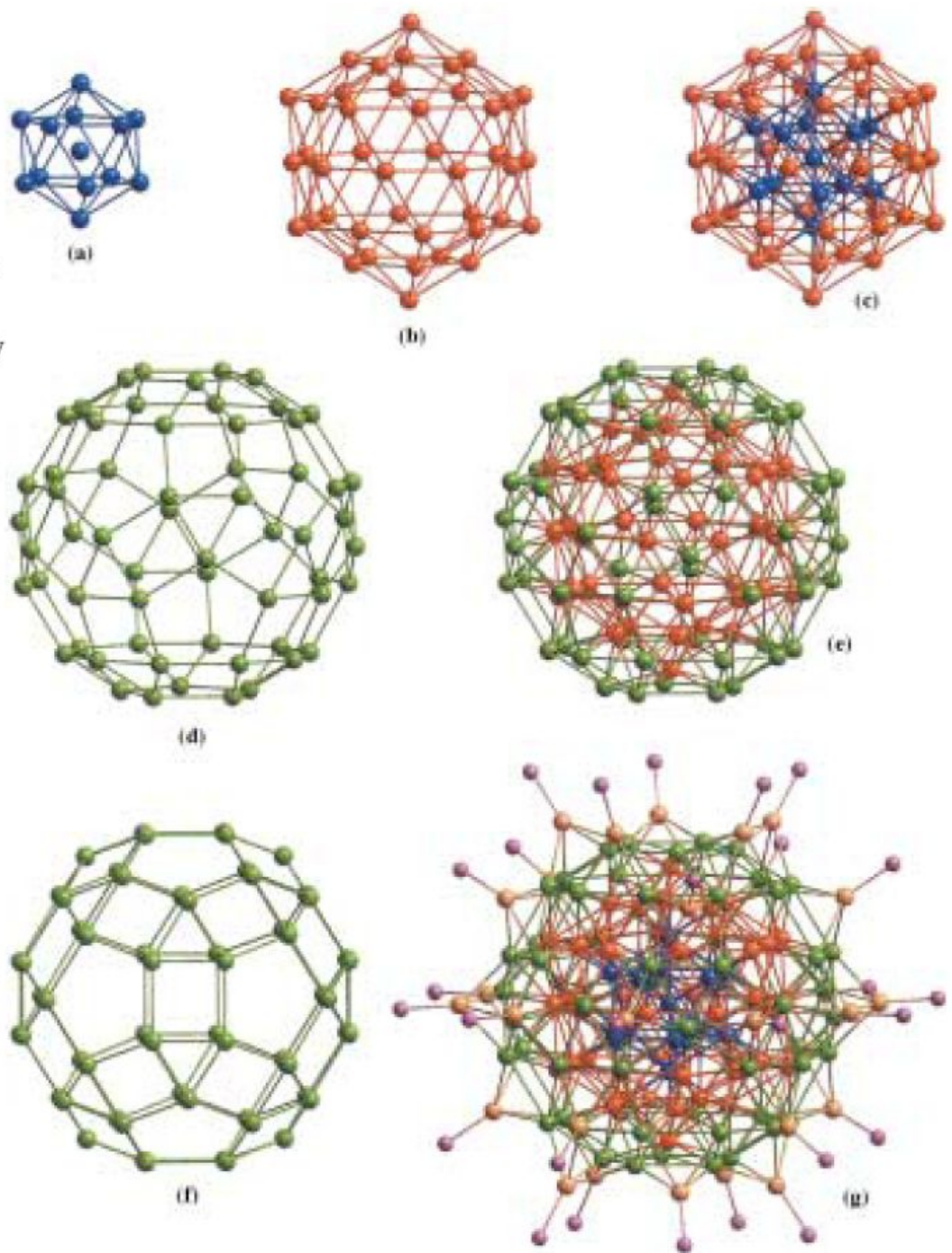
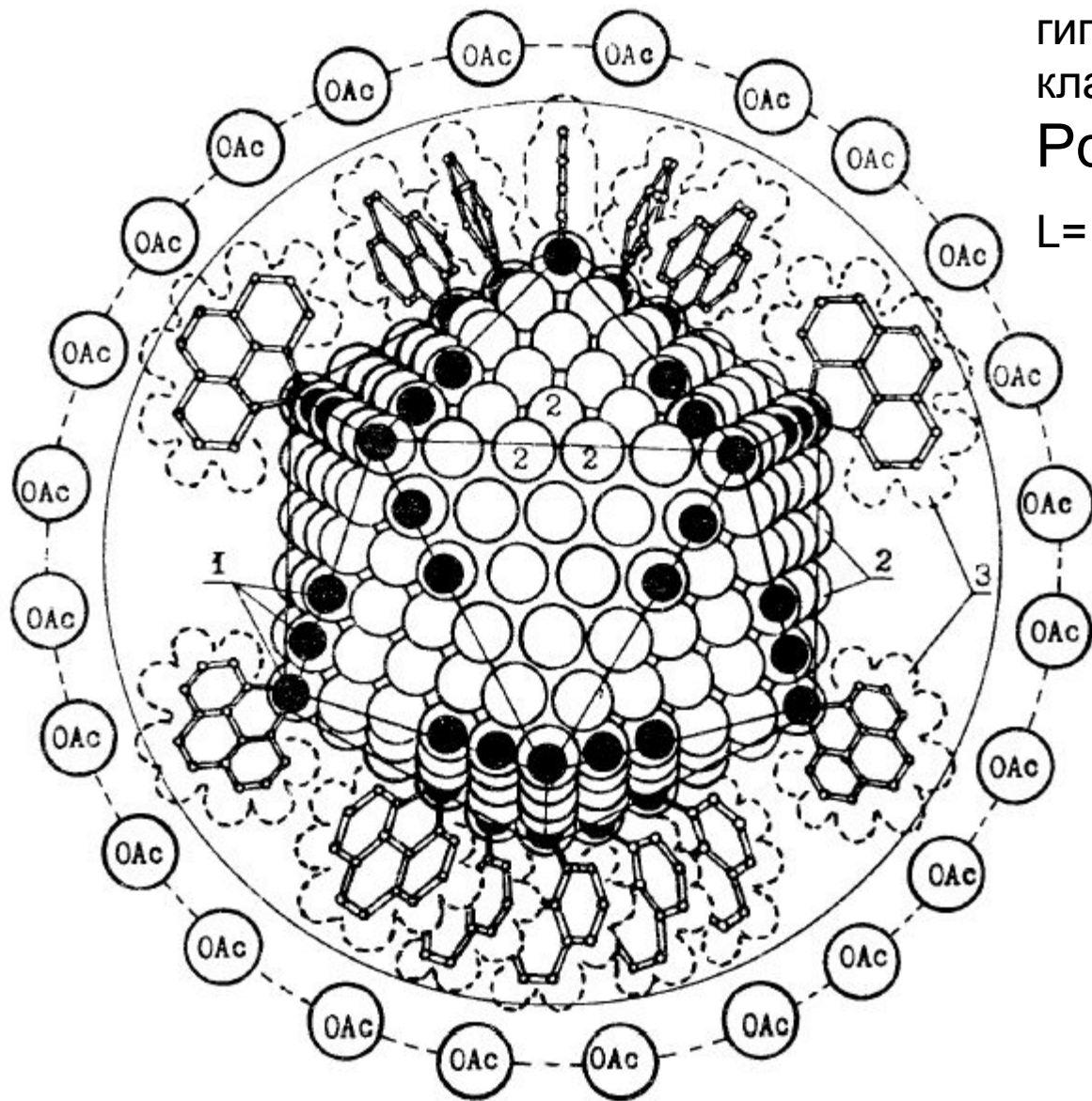


Figure 1. Formal concentric construction of the capped three-shell nanosized Pd₁₄₅ core of pseudo I_h symmetry in Pd₁₄₅(CO)_x(PEt₃)₃₀: a) 12-atom ν_1 icosahedron surrounding the central atom (ν_n denotes $(n + 1)$ equally spaced atoms along each edge). This centrosymmetrically centered icosahedron, one of the five regular Platonic solids (with equivalent vertices and identical faces composed of only one polygon), comprises: (1) six five-fold axes through opposite pairs of 12 vertices; (2) 10 three-fold axes through midpoints of opposite pairs of 20 triangular faces; and (3) 15 two-fold axes through midpoints of opposite pairs of 30 edges. b) 42-atom ν_2 icosahedron (shell 2) generated by the addition of an atom to the midpoint of each of the 30 edges of the 12-atom ν_1 icosahedron. c) Shell 2 encapsulating the Pd-centered shell 1 to give a 55-atom Mackay icosahedron. d) 60-atom polyhedron (shell 3), mathematically named a rhombicosidodecahedron (3.4.5.4). The numbers N (in parentheses) designate the Schläfli symbol which represents in cyclic order the polygons (N -gons) meeting at each equivalent vertex. e) Shell 3 encapsulating shell 2. f) Another orientation of the outermost third-shell polyhedron that more clearly shows the 60 equivalent vertices along with the 62 faces (namely, the 12 pentagons, 20 equilateral triangles, and 30 squares). This Archimedean polyhedron, a semi-regular one in that all 60 vertices are identical but there are three different polygons, has pseudo I_h symmetry. g) Entire 3-shell Pd₁₄₅ core including 30 exopolyhedral Pd atoms (with attached triethylphosphane P atoms (purple)) that form square pyramids by capping of the 30 square polygons of the third shell.

Длины связей Pd-Pd в икосаэдрической структуре Pd₁₄₅(CO)_x(PEt₃)₃₀

Connectivity ^[b]	<i>N</i> ^[c]	Mean [Å] ^[a]	Range [Å]
Pd(A)-Pd(B)	12	2.63 (2.63)	2.629(3) – 2.633(3)
Pd(B)-Pd(B)	30	2.77 (2.77)	2.757(4) – 2.778(5)
Pd(B)-Pd(C)	12	2.74 (2.73)	2.734(4) – 2.737(4)
Pd(B)-Pd(D)	60	2.70 (2.70)	2.696(4) – 2.709(4)
Pd(C)-Pd(D)	60	2.82 (2.82)	2.811(6) – 2.836(6)
Pd(D)-Pd(D)	60	2.82 (2.82)	2.810(5) – 2.825(6)
Pd(C)-Pd(E)	60	2.73 (2.73)	2.714(7) – 2.749(7)
Pd(D)-Pd(E)	120	2.74 (2.73)	2.724(6) – 2.756(6)
Pd(E)-Pd(E) (triangle/square shared edge)	60	2.82 (2.82)	2.795(8)-2.844(9)
Pd(E)-Pd(E) (pentagon/square shared edge)	60	3.09 (3.09)	3.070(8) – 3.112(9)
Pd(E)-Pd(F)	120	2.84 (2.84)	2.809(9)-2.874(9)

N – число эквивалентных по симметрии связей (при икосаэдрической *I_h* симметрии)



Предполагаемое строение
гигантского палладиевого
кластерного комплекса
 $\text{Pd}_{561}\text{L}_{60}(\text{O}_2)_{150}(\text{OAc})_{150}$
 L= bipy, phen

