

Rhenium Octahedral Chalcohydroxo Cluster Complexes



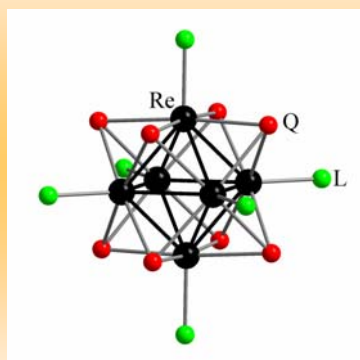
Y.V.Mironov, S.S.Yarovoi, K.A.Brylev, V.E.Fedorov



Nikolaev Institute of Inorganic
Chemistry, Russian Academy of Sciences,
Siberian Branch, Novosibirsk, Russia

Moscow, July 2011

Nikolaev Institute of Inorganic Chemistry SB RAS



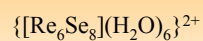
Q=S, Se, Te, Cl, Br, O

L=Cl, Br, I, OH, CN, SCN...

N-, P-, O-, S- donor organic ligands



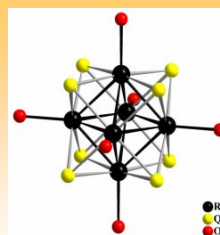
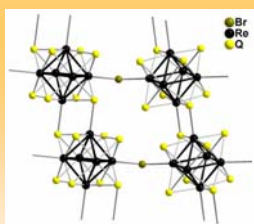
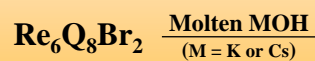
VEC=24e/Re₆



2

Nikolaev Institute of Inorganic Chemistry SB RAS

Octahedral Rhenium Chalcohydroxo Complexes

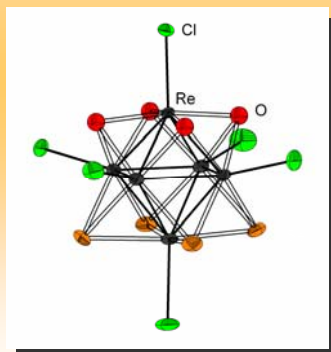


• S.S. Yarovoi, Y.V. Mironov, D.Y. Naumov, *et al.*
Eur. J. Inorg. Chem. **2005**, 3945–3949

3

Nikolaev Institute of Inorganic Chemistry SB RAS

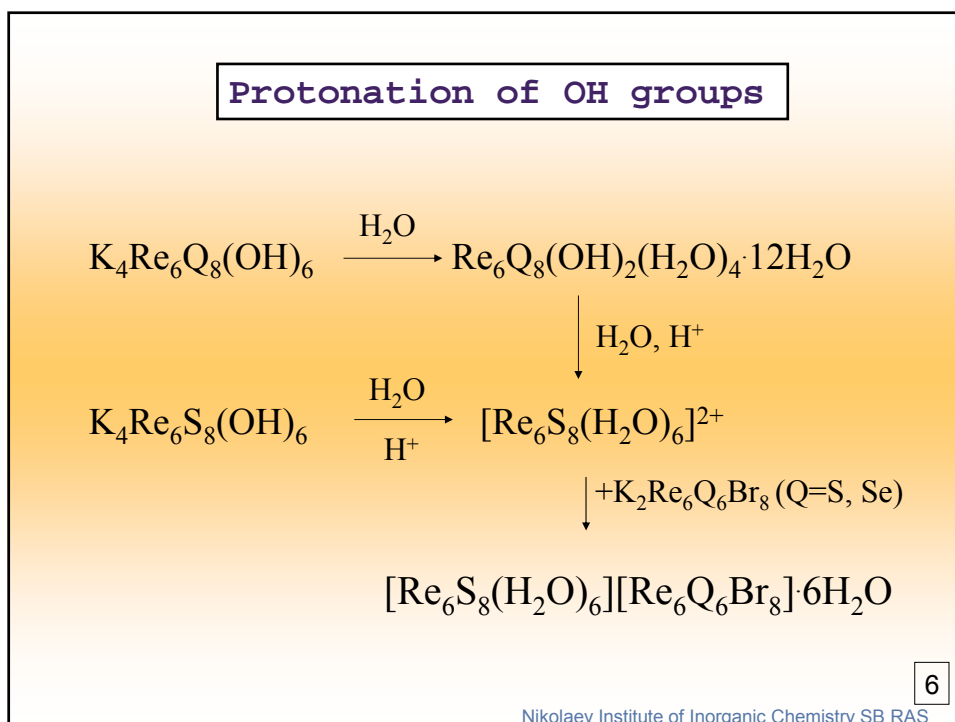
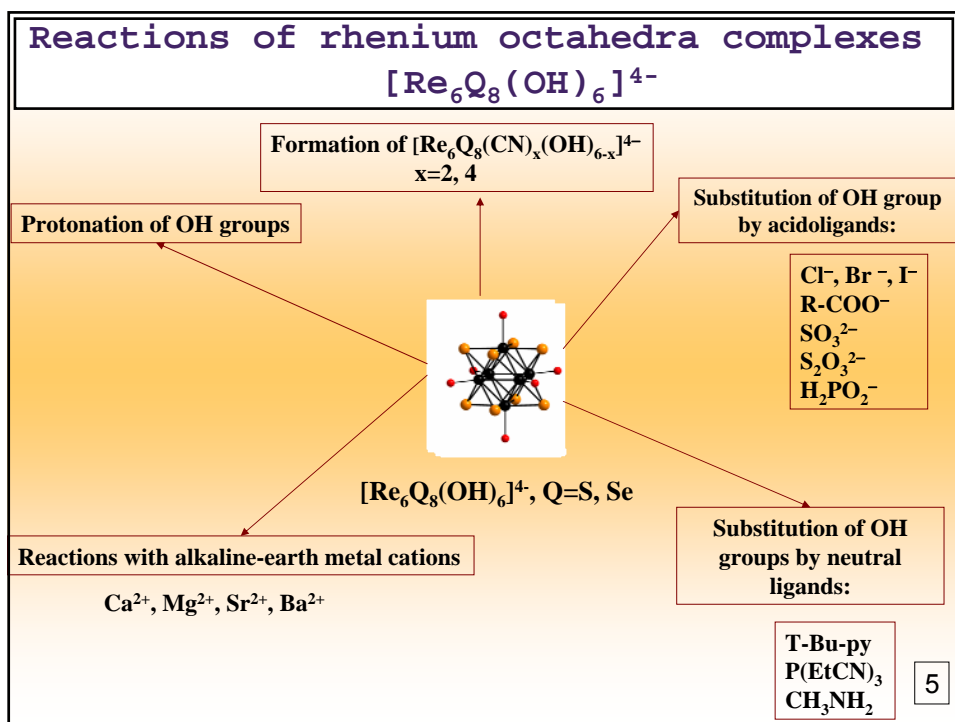
Synthesis and Structure of Rhenium Cluster Complex $\text{Cs}_{11}(\text{H}_3\text{O})[\text{Re}_6\text{Se}_4\text{O}_4\text{Cl}_6]_3$

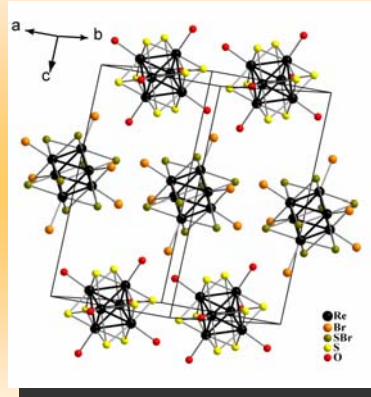
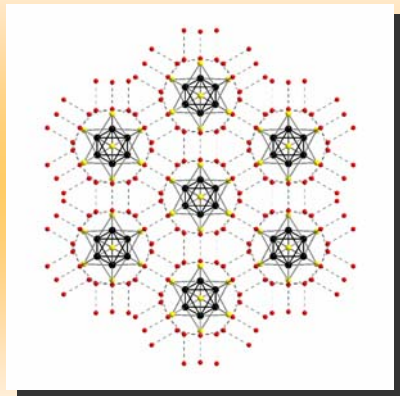
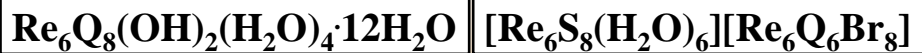


• S. S. Yarovoi, Y. V. Mironov, S. F. Solodovnikov,
D. Y. Naumov, N. K. Moroz, S. G. Kozlova, A.
Simon, V. E. Fedorov, *Chem. Commun.*, 2005,
719–721

4

Nikolaev Institute of Inorganic Chemistry SB RAS

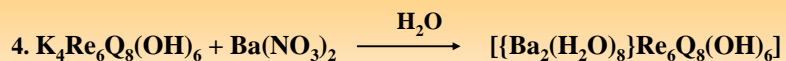
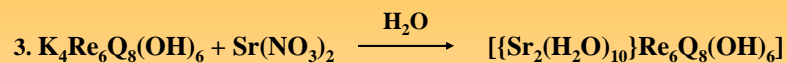
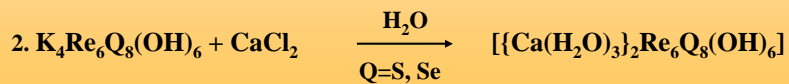
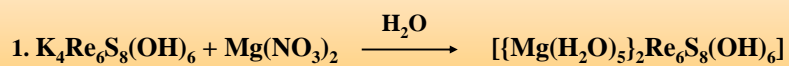




7

Nikolaev Institute of Inorganic Chemistry SB RAS

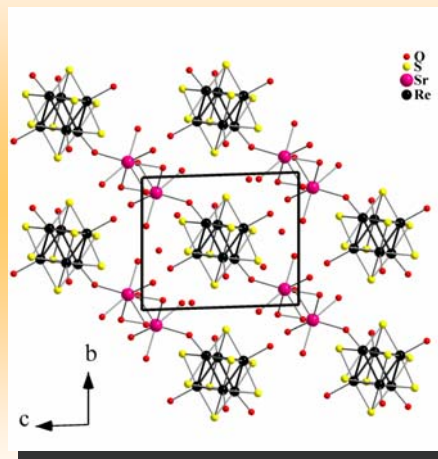
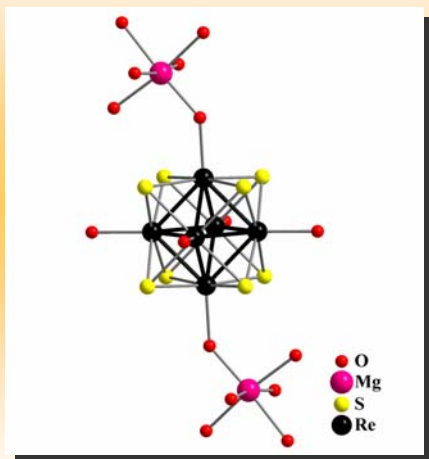
The First Coordination Polymers Based on Octahedral Hexahydroxo Rhenium Cluster Anions $[\text{Re}_6\text{Q}_8(\text{OH})_6]^{4-}$ (Q = S, Se) and Alkaline Earth Metal Cations



• Y.V. Mironov, V.E. Fedorov, H.J. Bang, S.-J. Kim, *Eur. J. Inorg. Chem.* **2006**, 553-557.

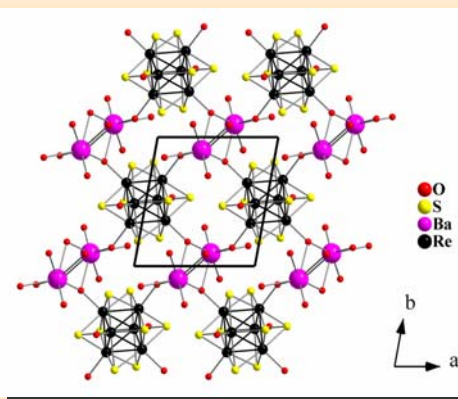
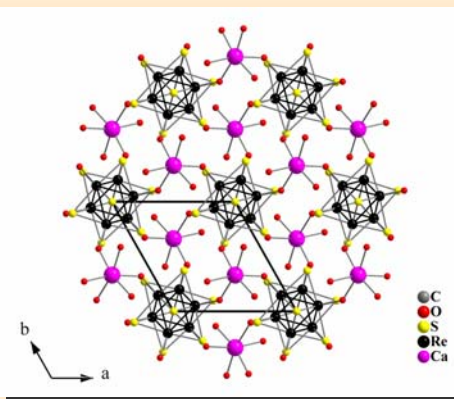
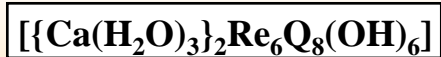
8

Nikolaev Institute of Inorganic Chemistry SB RAS



9

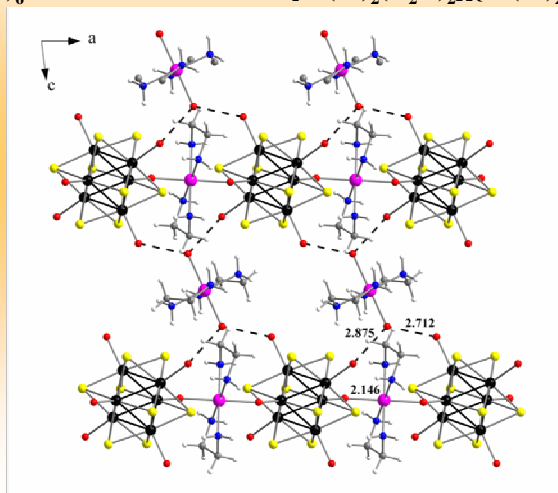
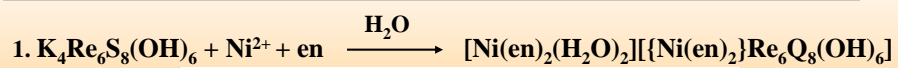
Nikolaev Institute of Inorganic Chemistry SB RAS



10

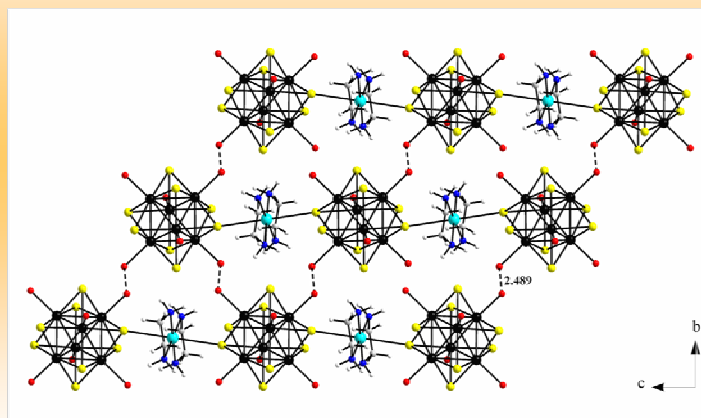
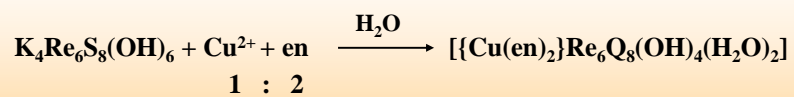
Nikolaev Institute of Inorganic Chemistry SB RAS

The First Coordination Polymers with 3d-transition Metals



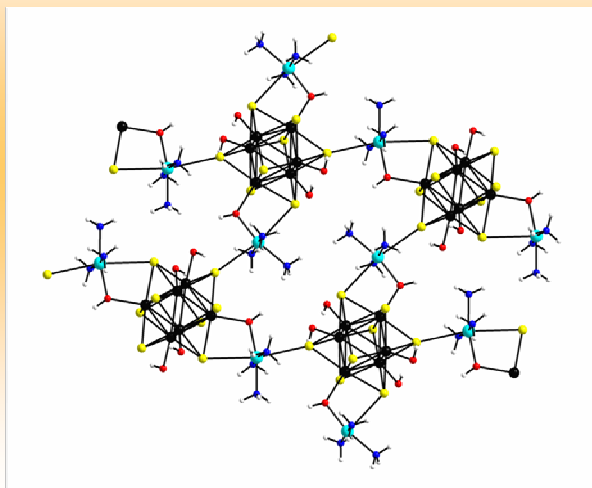
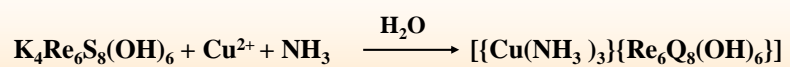
11

Nikolaev Institute of Inorganic Chemistry SB RAS



12

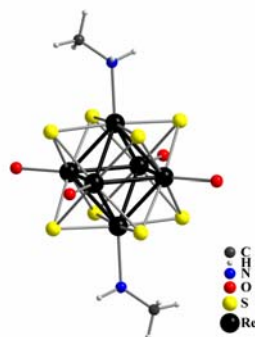
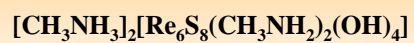
Nikolaev Institute of Inorganic Chemistry SB RAS



13

Nikolaev Institute of Inorganic Chemistry SB RAS

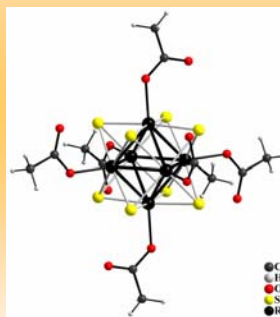
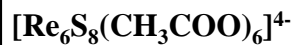
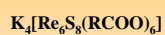
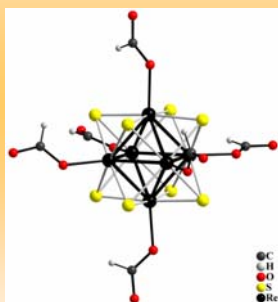
Interaction of $\text{K}_4\text{Re}_6\text{S}_8(\text{OH})_6$ with Amines



14

Nikolaev Institute of Inorganic Chemistry SB RAS

Interaction of $K_4Re_6S_8(OH)_6$ with Acides



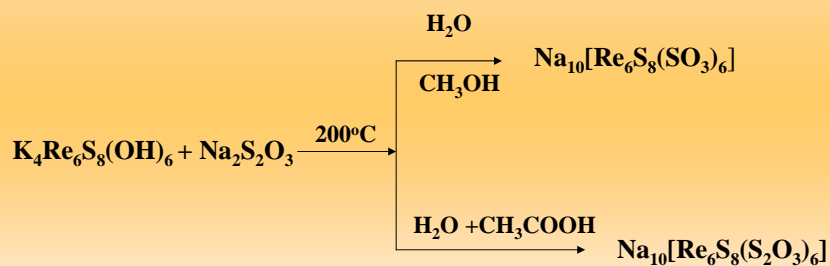
K.A. Brylev, Y.V. Mironov, S.G. Kozlova, V.E. Fedorov, S.-J. Kim, H.-J. Pietzsch, H. Stephan, A. Ito, S. Ishizaka, N. Kitamura // *Inorg. Chem.* – 2009 – V. 48 – P. 2309-2315.

K.A. Brylev, Y.V. Mironov, V.E. Fedorov, S.-J. Kim, H.-J. Pietzsch, H. Stephan, A. Ito, N. Kitamura // *Dalton Trans.* – 2009 – submitted.

15

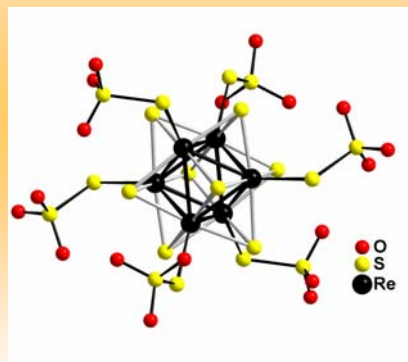
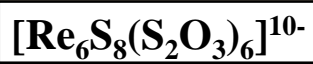
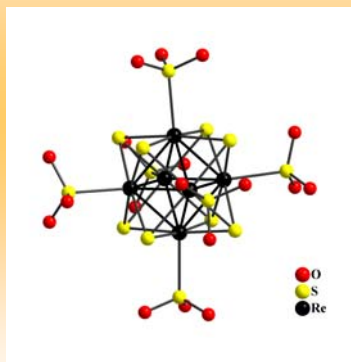
Nikolaev Institute of Inorganic Chemistry SB RAS

Interaction of $K_4Re_6S_8(OH)_6$ with Salts



16

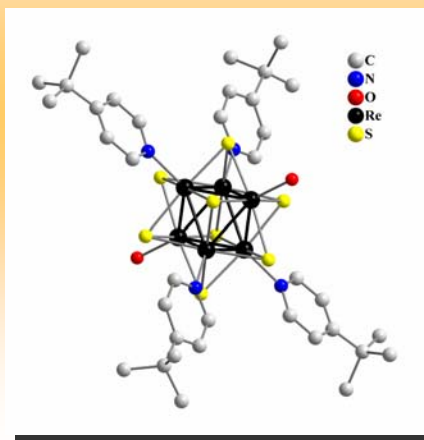
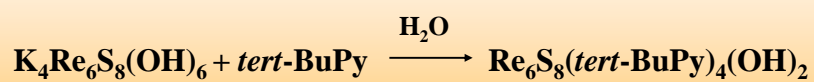
Nikolaev Institute of Inorganic Chemistry SB RAS



17

Nikolaev Institute of Inorganic Chemistry SB RAS

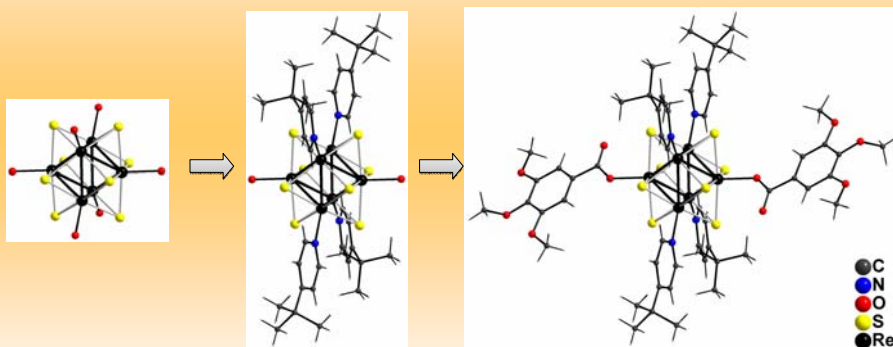
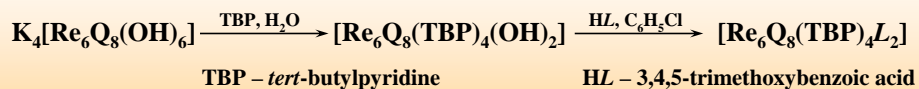
Interaction of $\text{K}_4\text{Re}_6\text{S}_8(\text{OH})_6$ with Organic Compounds



18

Nikolaev Institute of Inorganic Chemistry SB RAS

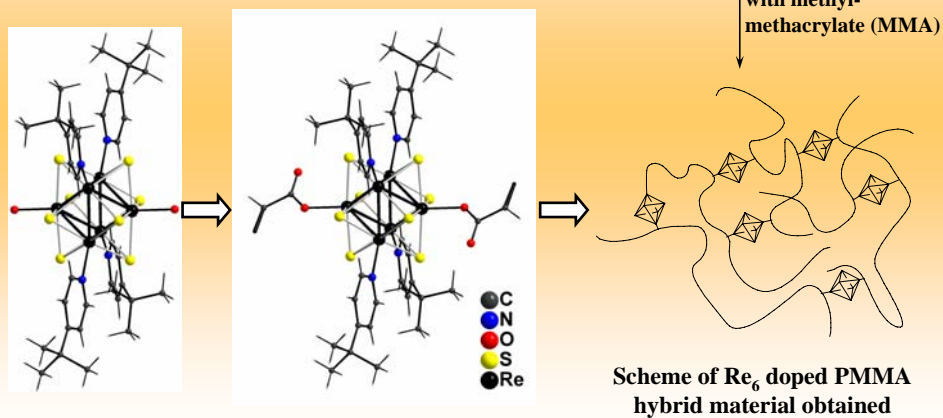
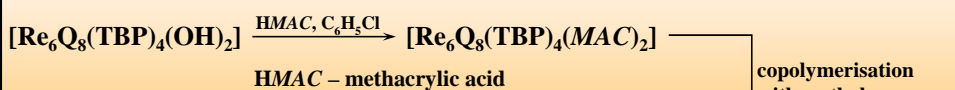
Selective functionalisation of Re₆ cluster anionic units



F. Dorson, Y. Molard, S. Cordier, B. Fabre, O. Efremova, D. Rondeau, Y. Mironov, V. Circu, N. Naumov, C. Perrin, Selective functionalisation of Re-6 cluster anionic units: from hexa-hydroxo $[\text{Re}_6\text{Q}_8(\text{OH})_6]^{4-}$ (Q = S, Se) to neutral *trans*- $[\text{Re}_6\text{Q}_8\text{L}_4\text{L}'_2]$ hybrid building blocks // *Dalton Trans.* – 2009 – No. 8 – P. 1297-1299.

19

Preparation of Re₆ doped PMMA hybrid material



20

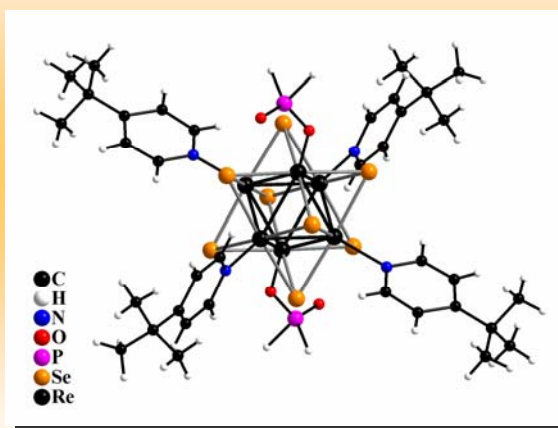
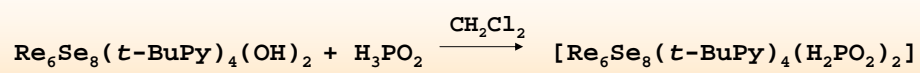
Luminescence of Re_6 doped PMMA hybrid material



Digital photographs of the PMMA and Re_6 -PMMA pellets.

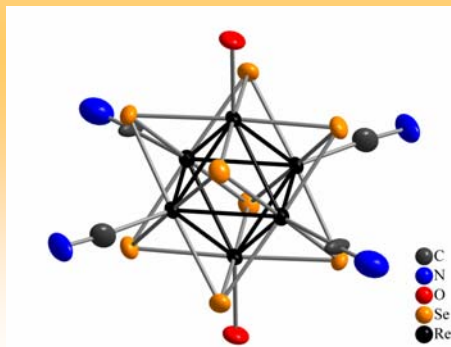
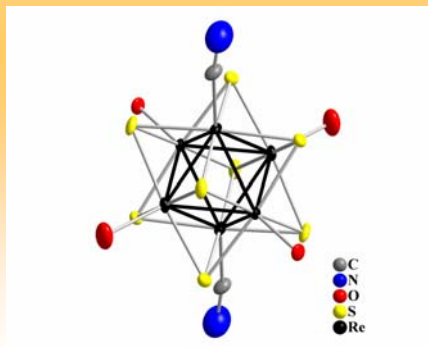
Top: under normal day light; bottom: under UV irradiation at $\lambda_{\text{ex}} = 365 \text{ nm}$.
The weight percentage of cluster increases from left to right: 0, 0.025, 0.05, and 0.1 wt%.

21



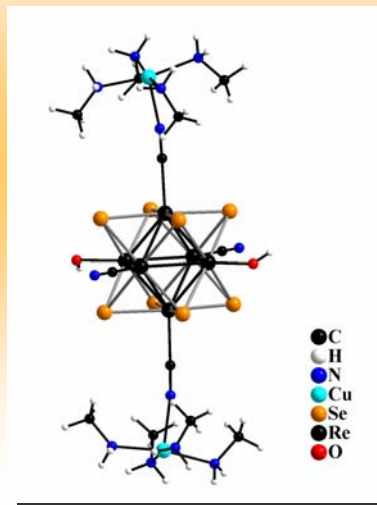
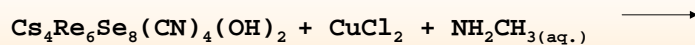
22

Cyanohydroxo Complexes: a New Group of Re_6 Cluster Compounds with Different Type of Terminal Ligands.



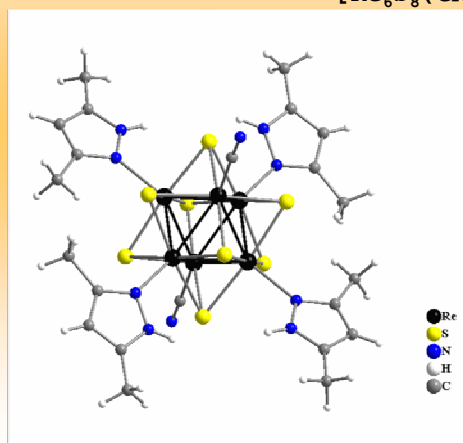
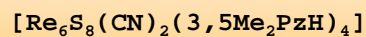
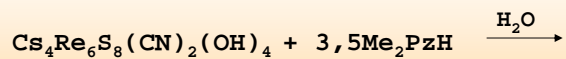
23

Cyanobridged Complexes



24

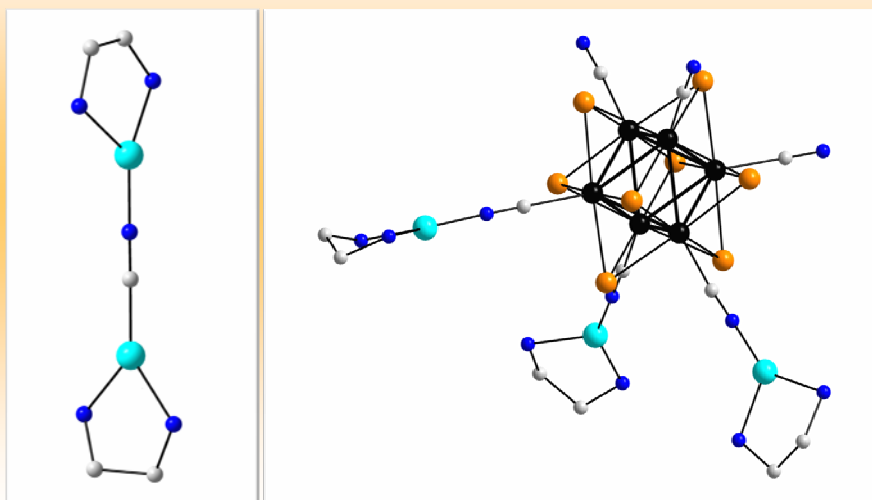
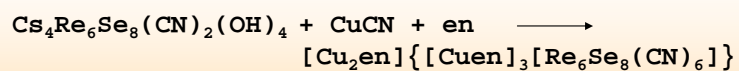
Substitution of OH ligands by organic molecular



25

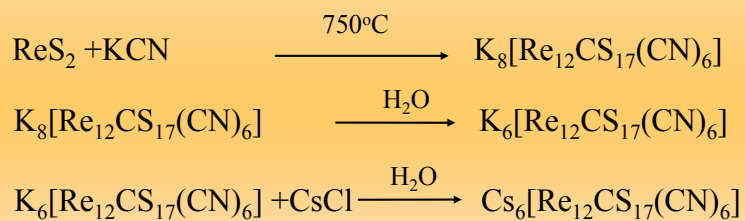
Nikolaev Institute of Inorganic Chemistry SB RAS

Substitution of OH ligands by CN ligands



Nikolaev Institute of Inorganic Chemistry SB RAS

Novel Re_{12} Chalcocyanide Cluster Complexes $[\text{Re}_{12}\text{CS}_{17}(\text{CN})_6]^{6-/8-}$

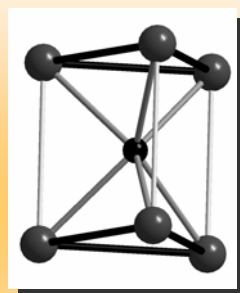
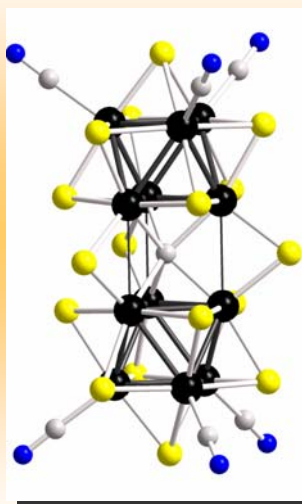


• Y.V. Mironov, N.G. Naumov, S.G. Kozlova, S.-J. Kim, V.E. Fedorov *Angew. Chem. Int. Ed.* **2005**, 44, 6867–6871

26

Nikolaev Institute of Inorganic Chemistry SB RAS

Structure of cluster anions $[\text{Re}_{12}\text{CS}_{17}(\text{CN})_6]^{6-/8-}$



Anion 8- Re-Re = 3.178-3.184 Å

Anion 6- Re-Re = 2.904 Å

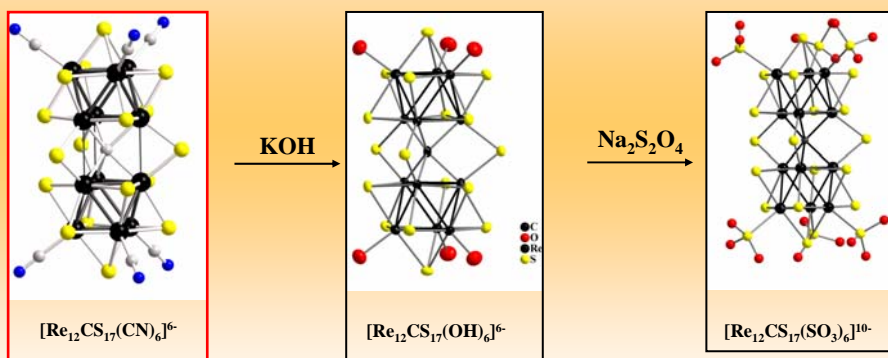


• Y.V. Mironov, N.G. Naumov, S.G. Kozlova, Sung-Jin Kim, V.E. Fedorov, *Angew. Chem., Int. Ed. Engl.*, **2005**, v.44, pp.6867-6871.

27

Nikolaev Institute of Inorganic Chemistry SB RAS

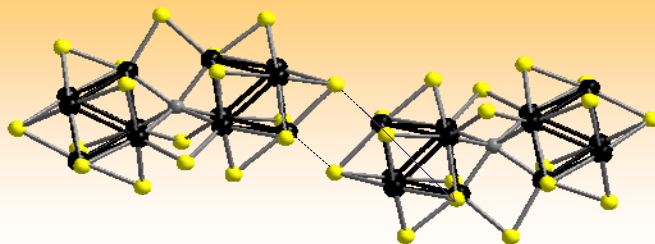
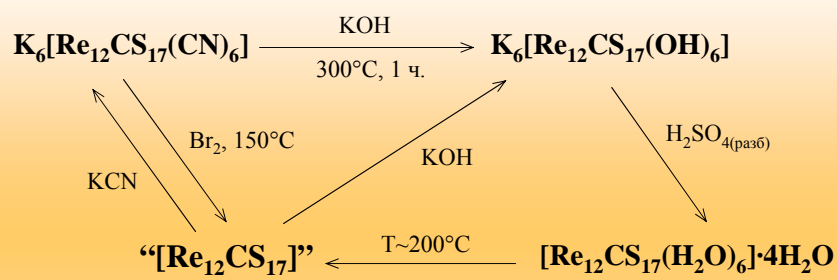
Reactions of rhenium bioctahedra
complex $[\text{Re}_{12}\text{CS}_{17}(\text{CN})_6]^{4-}$



28

Nikolaev Institute of Inorganic Chemistry SB RAS

" $\text{Re}_{12}\text{CS}_{17}$ "



29

Thank you for attention