

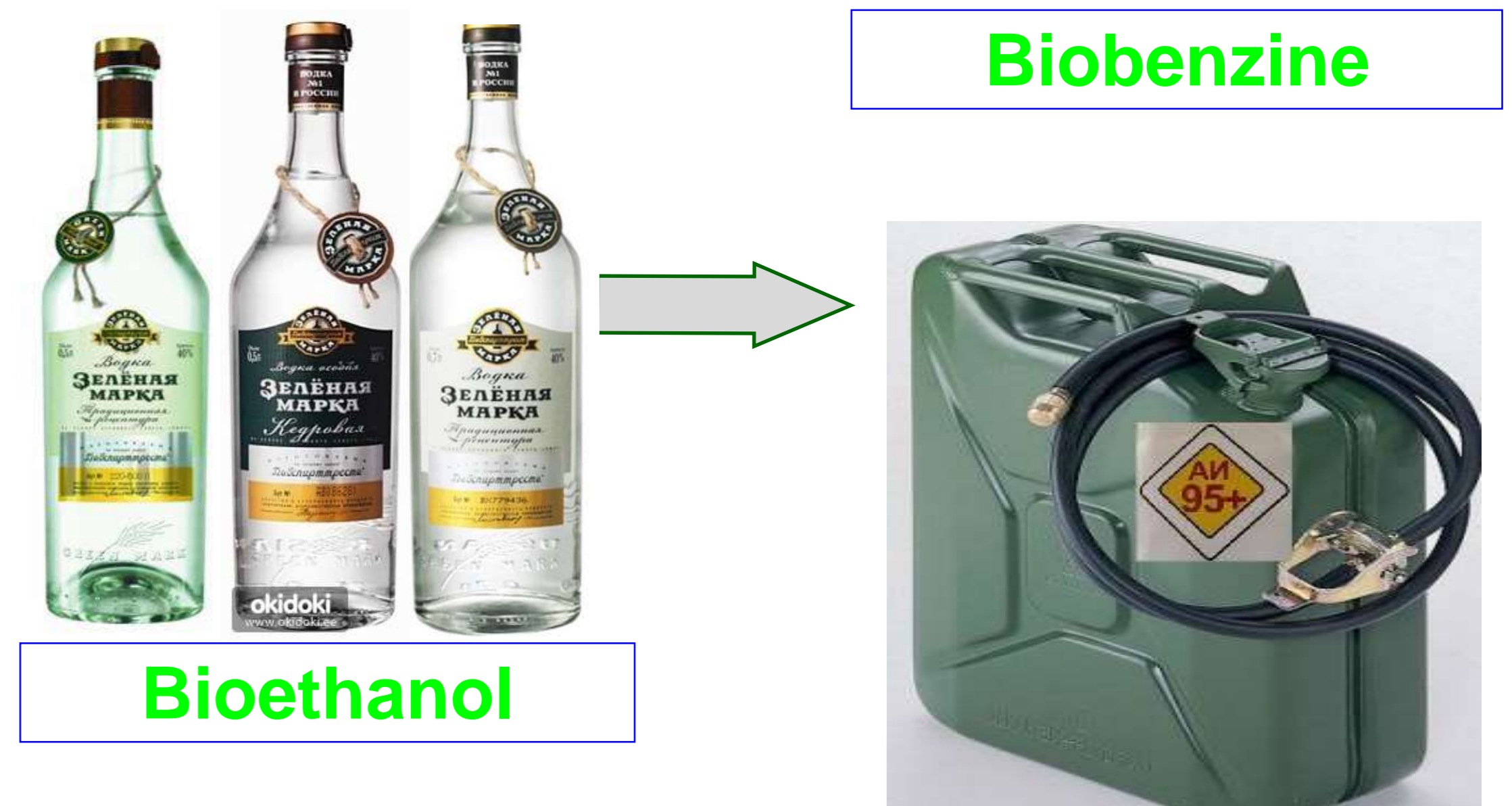
Structural study of bimetallic catalytic nanosystems containing precious metals by XAFS spectroscopy

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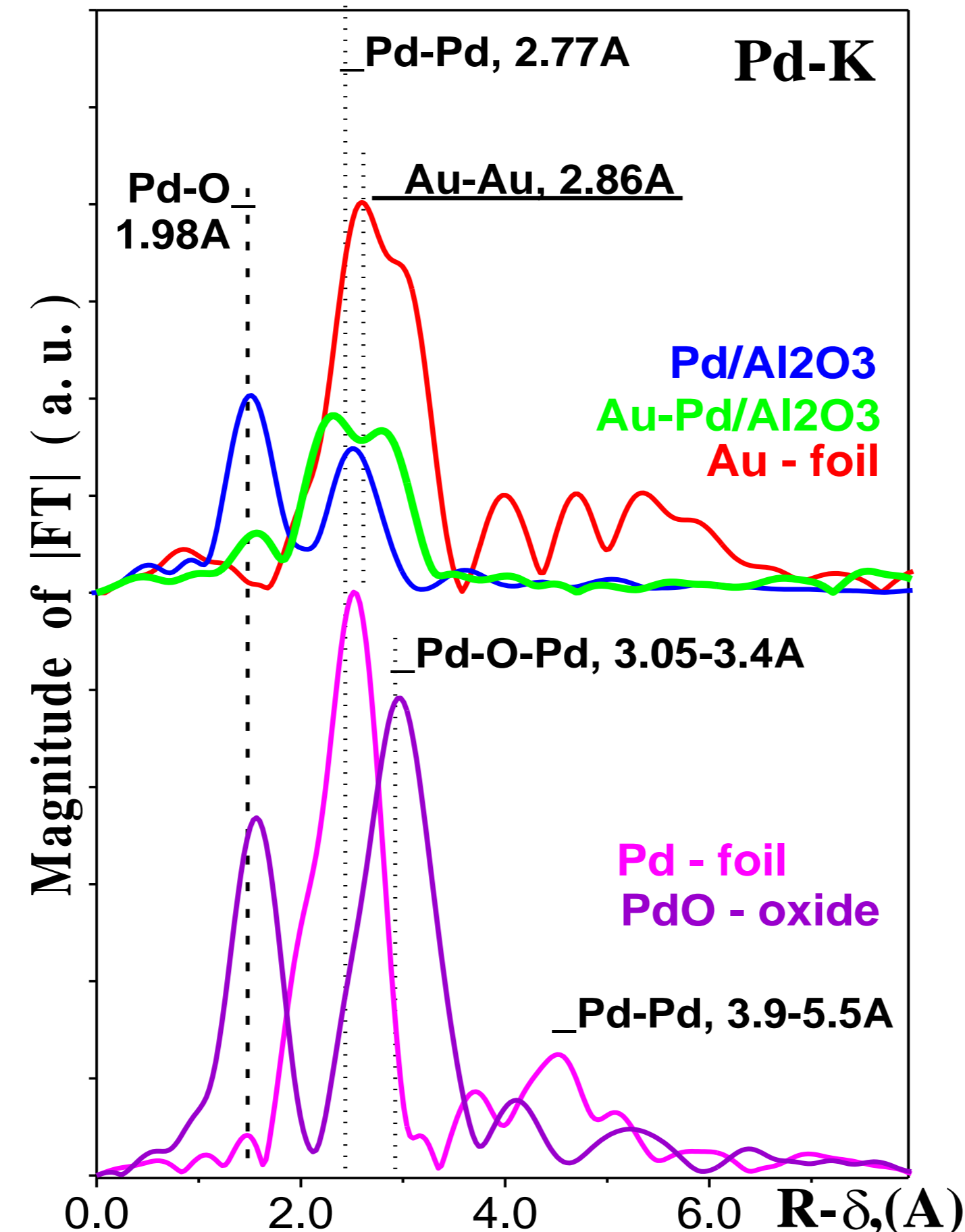
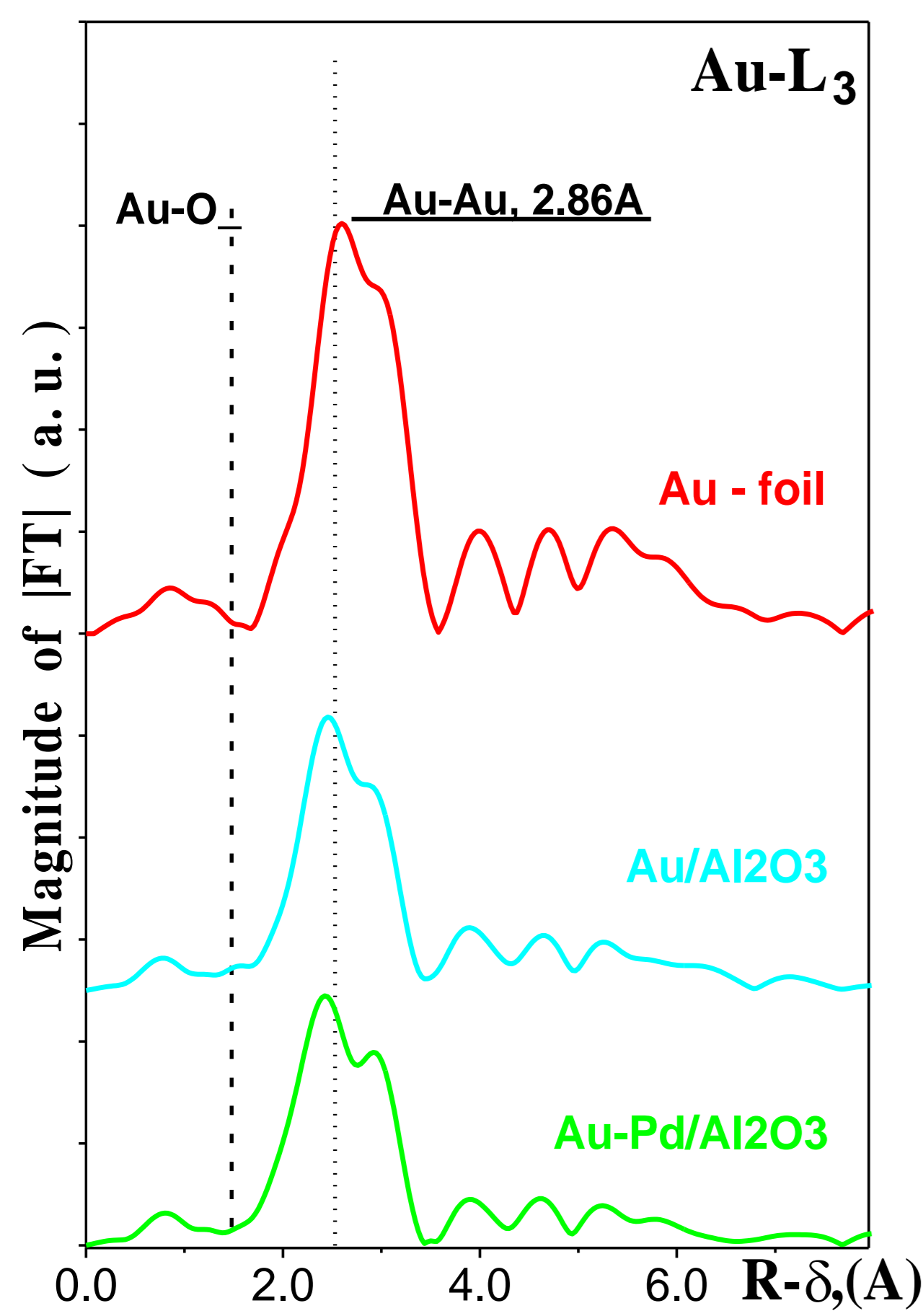
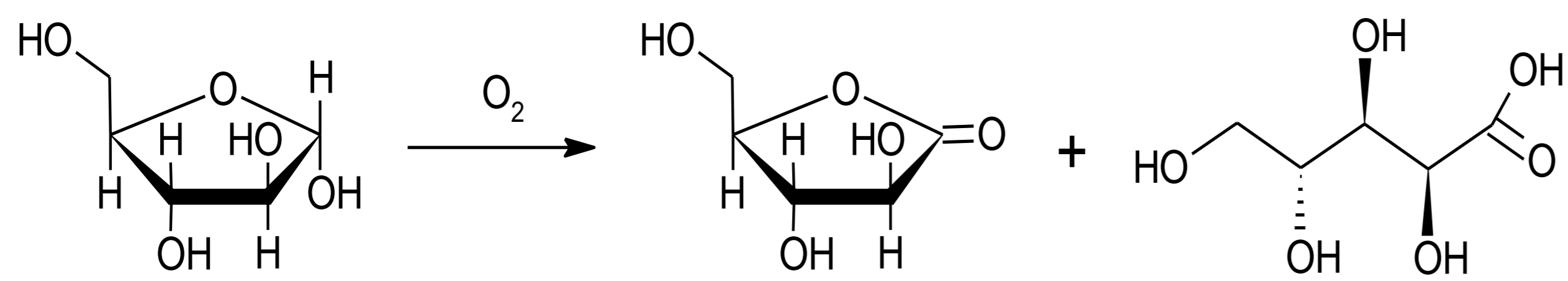
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This work is devoted to a detailed structural study of the nanosized Au, Au-Me stabilized forms located on oxide supports by XAFS method. It is a well known fact that metallic gold is most inert among the precious metals due to its electronic structure, nevertheless the nanosized Au, Au-Me forms located on oxide supports may be used as very active catalysts for numerous industrially important reactions. These systems are very promising for complex organic synthesis, selective isomerization reactions and for processes of environmental catalysts, such as, CO oxidation and selective conversion of secondary alcohols. Synthesis of low-percentage ~ 0.1-2% Au, Au-Me samples was carried out under varying preparation methods. All XAFS spectra (Au-L3 edge) of the studied samples were recorded at SSTRC, Novosibirsk. The state of metal components and the local Au structure arrangements of the prepared catalysts were studied. The Au-O, Au-Au, Au-Me interatomic distances and corresponded coordination numbers were established. All possible structural models were discussed.

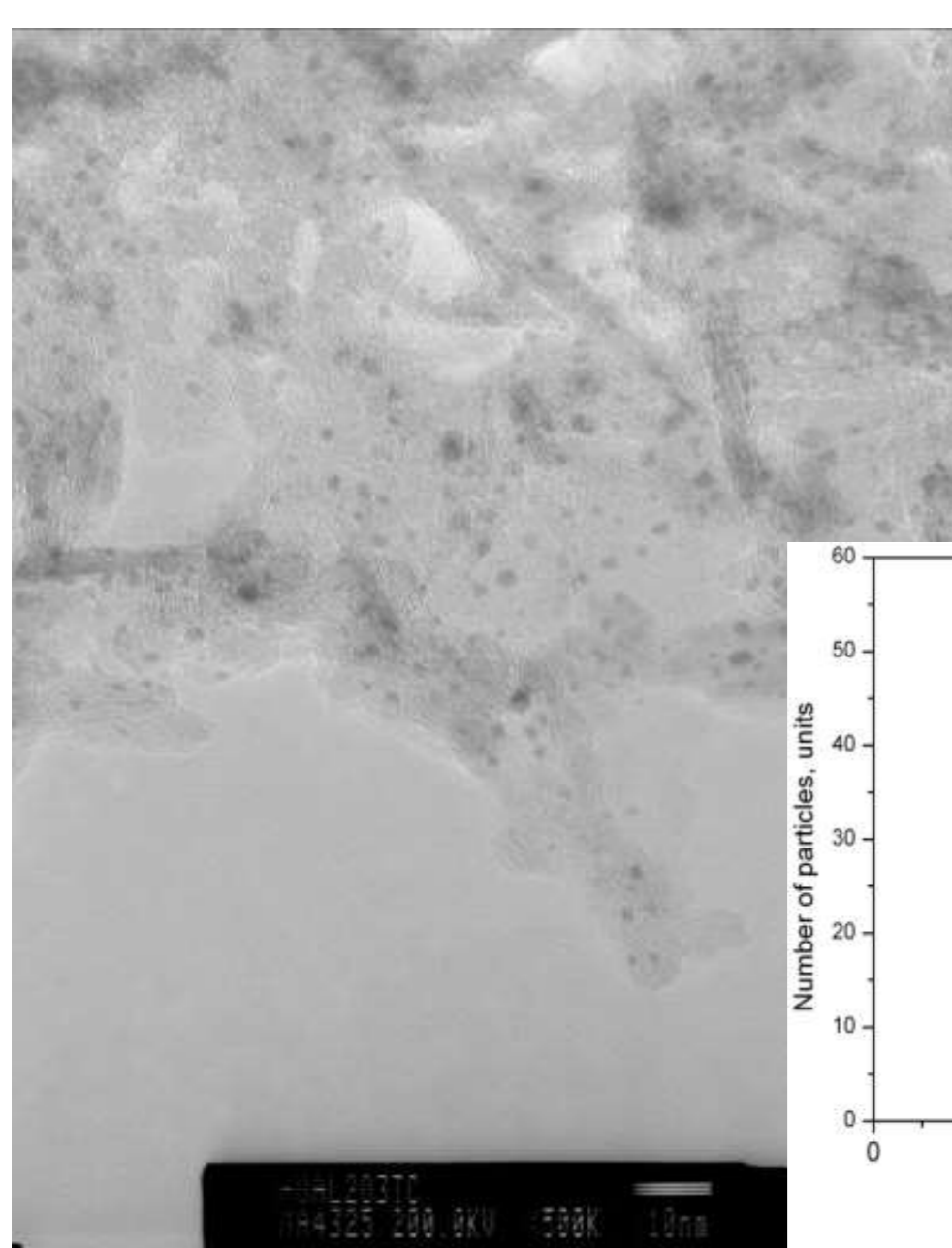
Au-Ni Catalytic nanosystem:



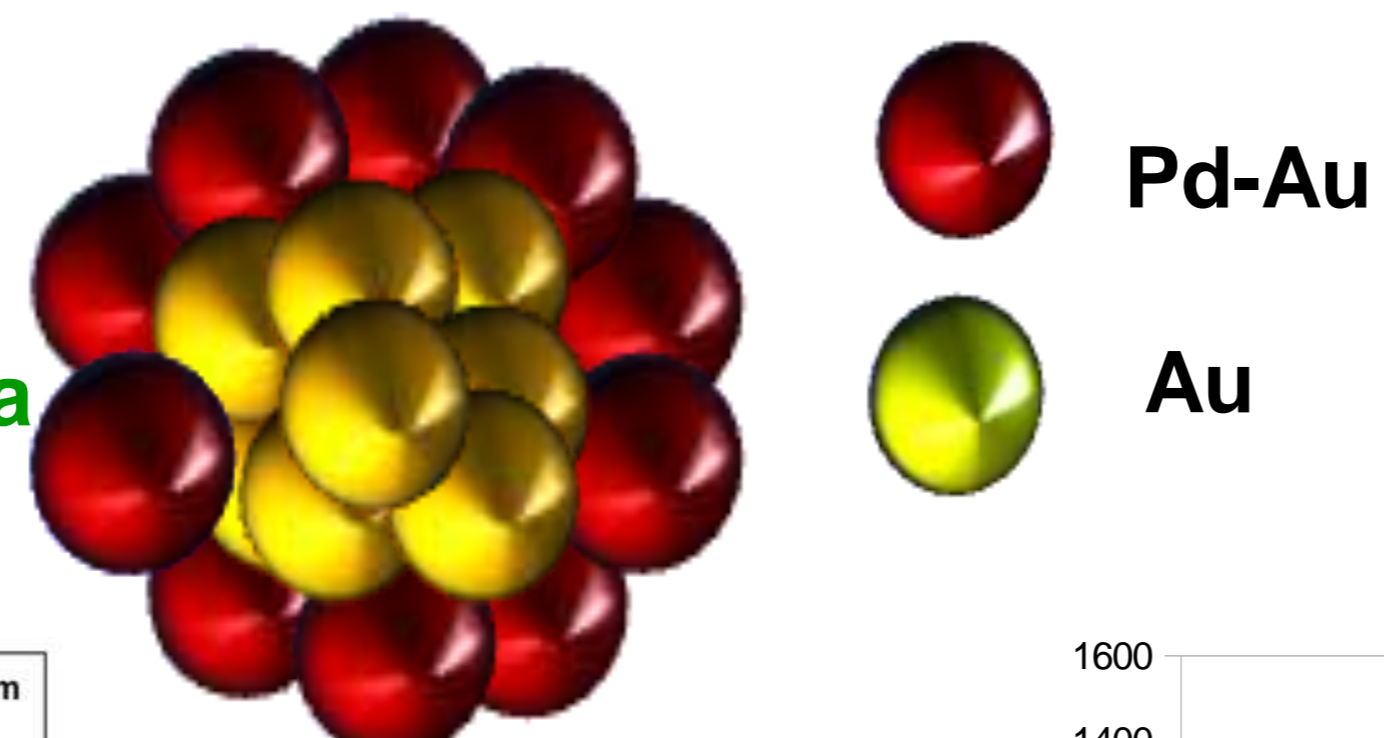
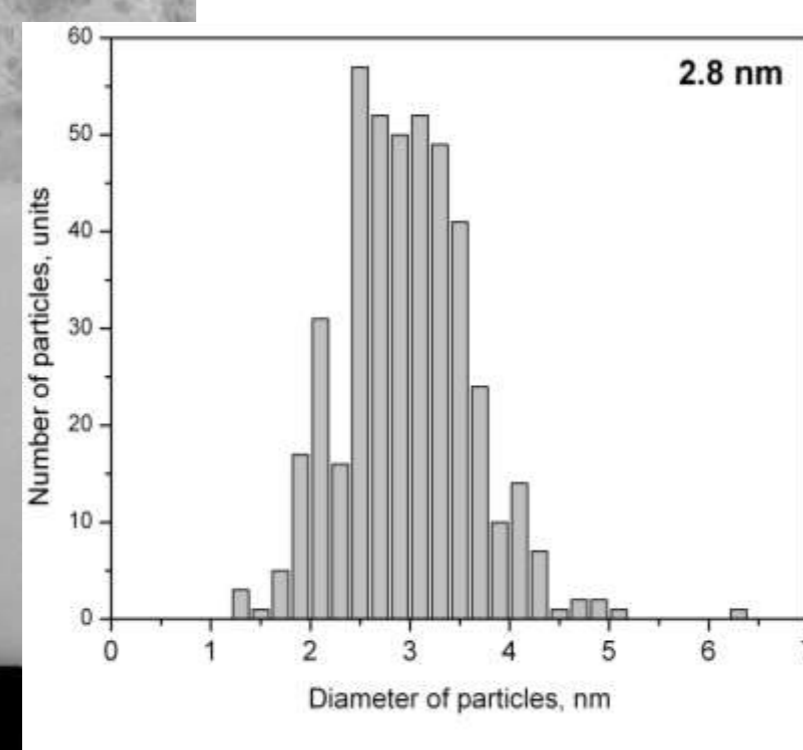
Au-Pd Catalytic nanosystem:



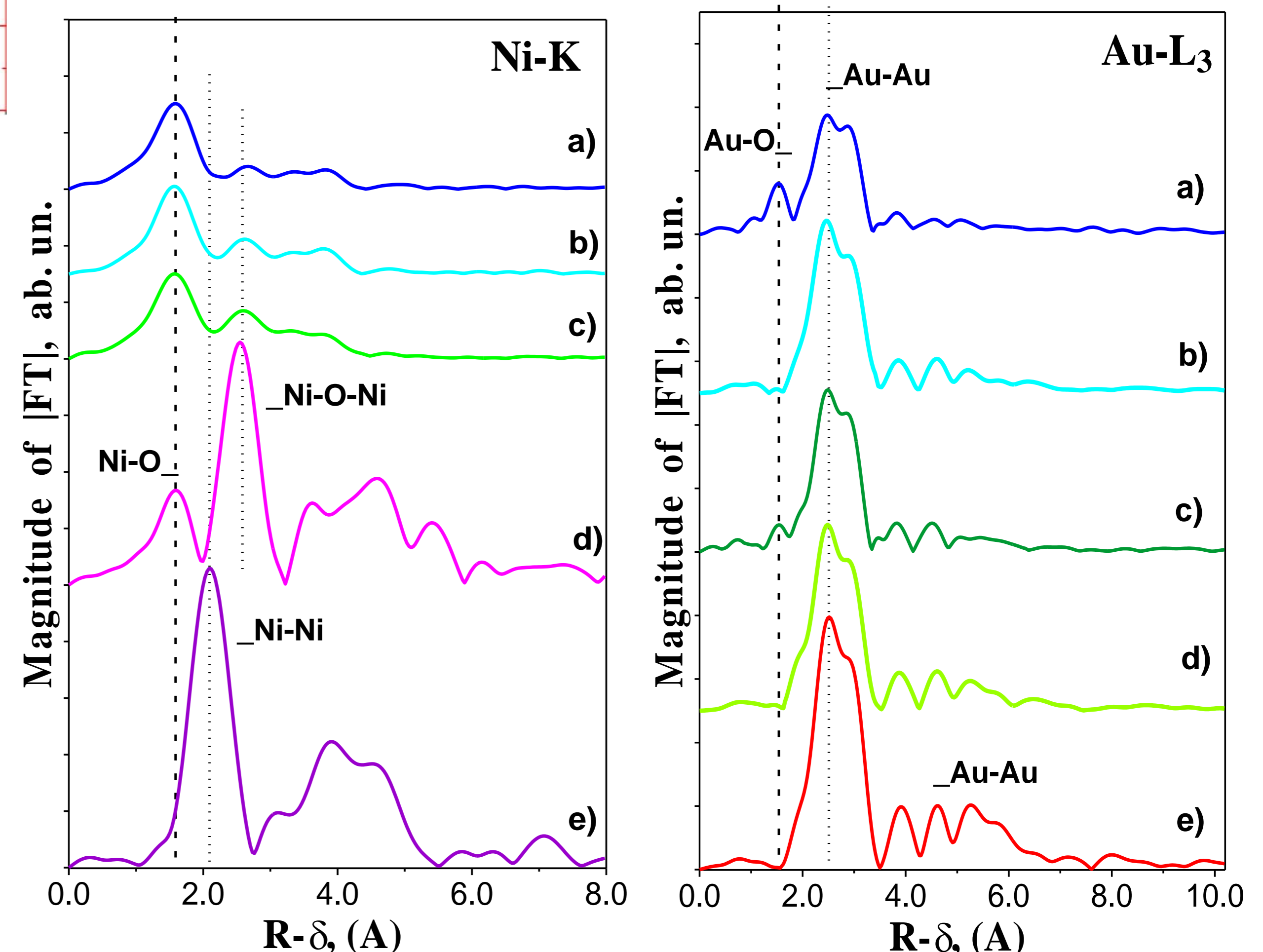
Proposed model of formation of Au-Pd active component on the support surface



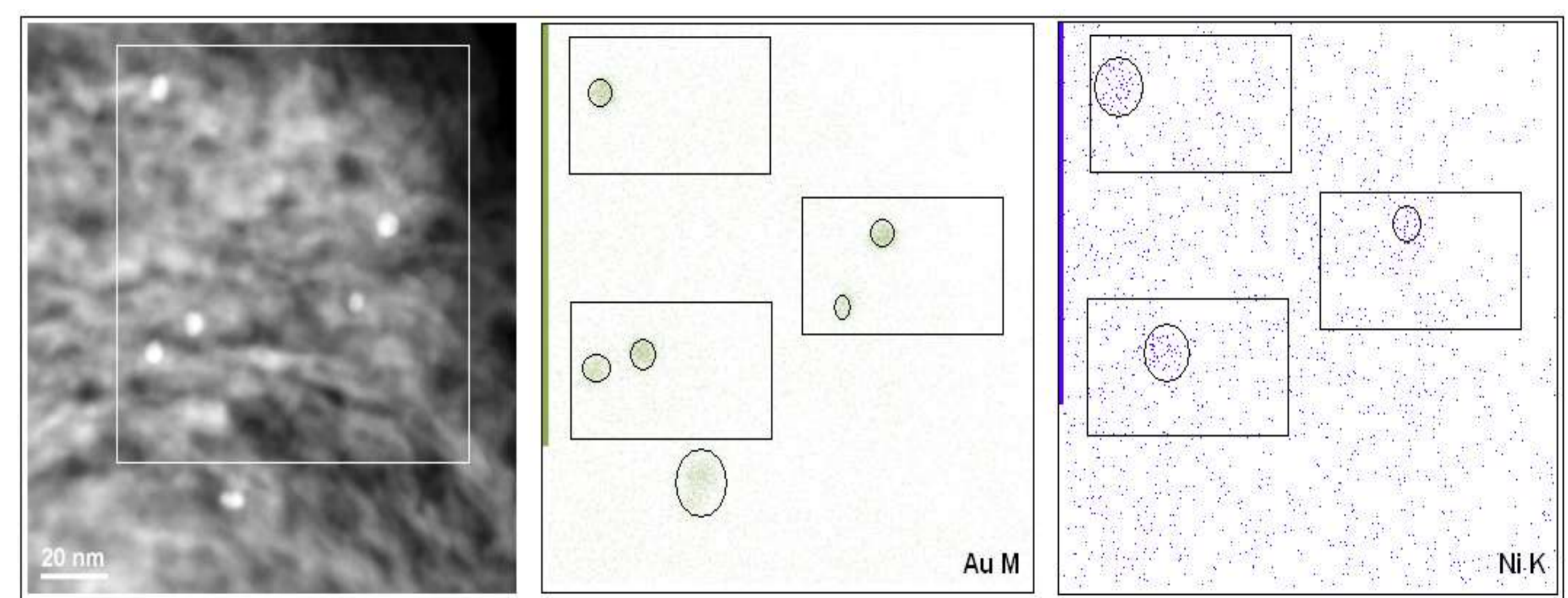
HRTEM Data



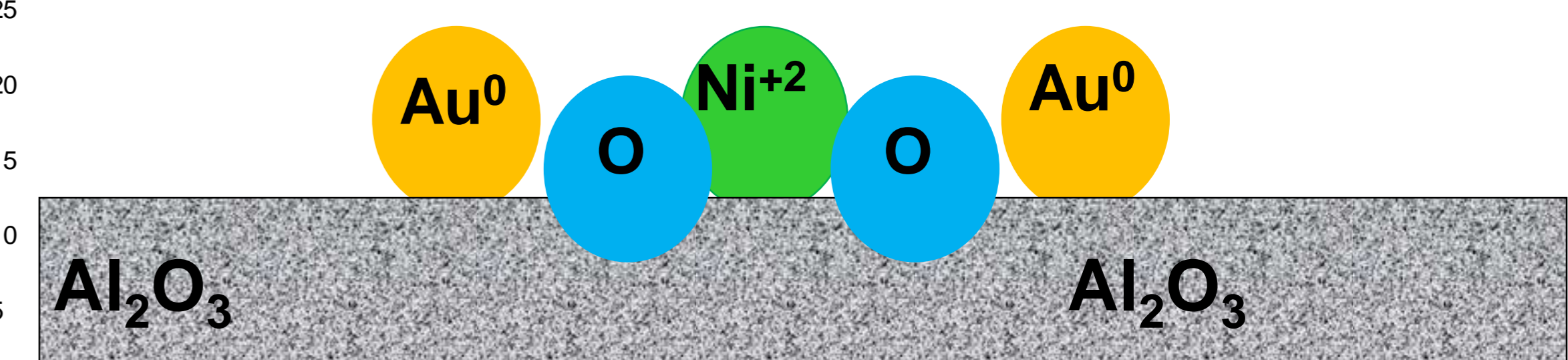
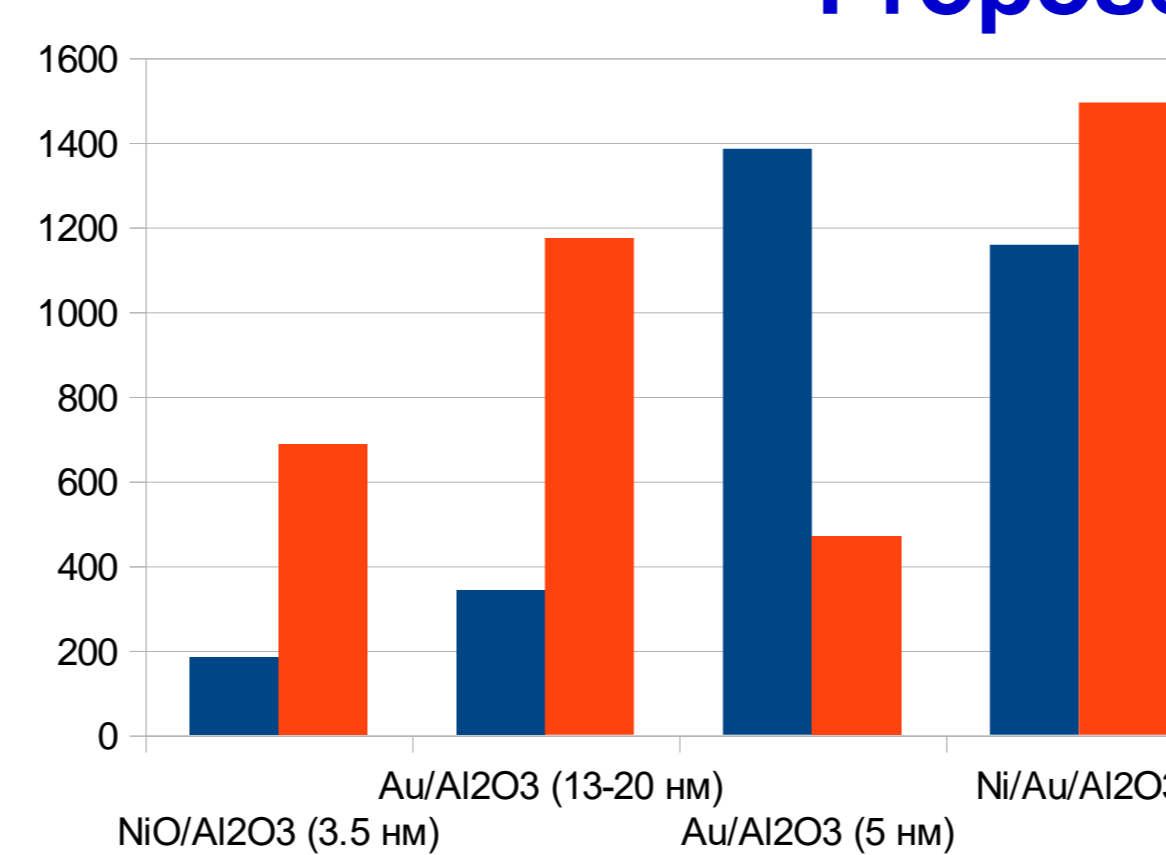
Curves of radial distribution function of atoms (RDFs) describing of nickel local arrangement for samples studied: (a) 0.21%Au+0.21%Ni/Al2O3 (before reduction), (b) 0.21%Ni/Al2O3 (after reaction), (c) 0.21%Au+0.21% Ni/Al2O3 (after reaction), (d) 0.15% Ni/Al2O3 (after reaction), (e) bulk NiO, (f) NiO foil.



HRTEM data for NiO/Au/Al2O3 (0.1 % Au + 0.03 % Ni) sample (before and after reactions)



Proposed model of formation of Au-Ni active component on the support surface



It was shown that different stabilized gold forms located on oxide supports were formed, most probably depending on a sample prehistory: Au(3+) cations, having octahedral oxygen surrounding and metallic Au-Au, Au-Me nanoparticles ~10-50Å. Some correlations between catalytic activities and structural functional properties of the studied samples were shown. Additionally, samples of catalysts were characterized by the TEM, EDX, XRD, XPS methods. The data obtained by all the methods are in a good agreement.

The work was done using the infrastructure of the Shared-Use Center "Siberian Synchrotron and Terahertz Radiation Center" based on VEPP-3 of BINP SB RAS.