Icosahedral Islands in Pd Film for TSC Jitterbug Fusion

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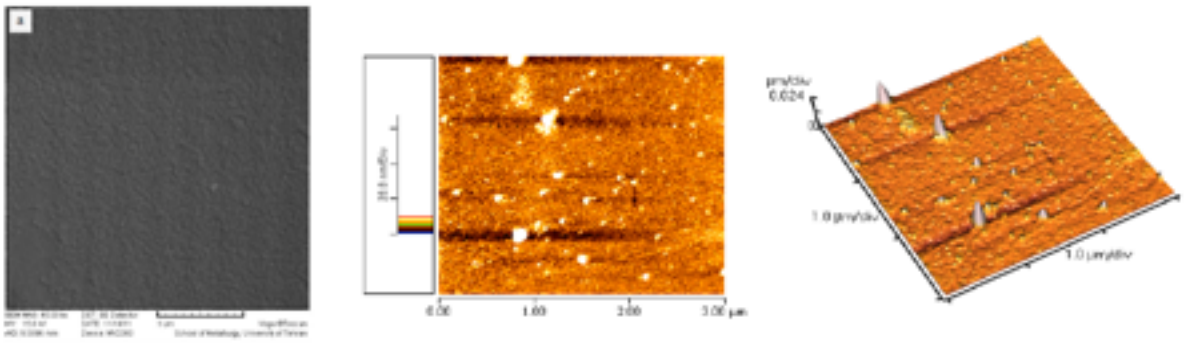
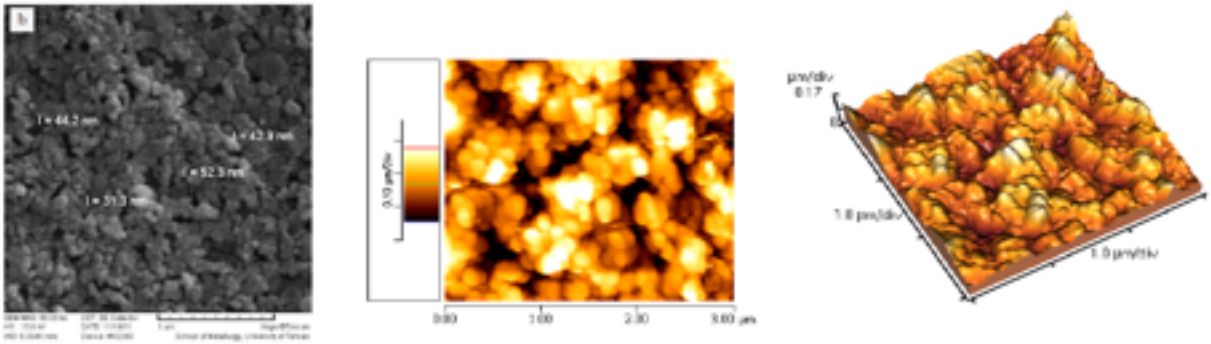
Feridoun Samavat, Parisa Taravati Ahmad, Farzane Mahmoodi,
Mohammad Faraz Samavat, and Mohammad Hossein Tavakoli in their paper
"The Effect of Annealing on the Size and Morphology of Palladium Nanoparticles"
(American Journal of Condensed Matter Physics 2 (2012) 73-76) said:

"… **thin film palladium on glass/silicon substrate**
is deposited by the electron beam coating method ...



... The films are subsequently reduced to form nanoparticlat palladium film by increasing temperature ... The temperatures of annealing process were 450 degrees C ... The structure characterizations of the thin films were obtained by X-ray diffraction. …
The average crystallite size ... by ... XRD … were ... 3 nm … for 450 degrees C …
… The Pd nanoparticles ... was observed by using SEM and AFM ...



... SEM … showed a grain structure … size of grains … 44 nm … for 450 degrees C …
The Atomic Force Microscopy (AFM) images confirmed results ...
that ... increasing ... temperature ... increases crystal structure ...".

The UnAnnealed Pd Film is made up mostly of single Pd atoms (radius 0.137 nm) with no more than a few clusters (size less than a nanometer with 13 or fewer atoms).

The 3 nm crystallite size corresponds to Palladium clusters of about 923 atoms.
By using Annealing Temperature less than 450 degrees C
crystallite size should be about 1.5 nm corresponding to Pd cluster of 147 atoms.

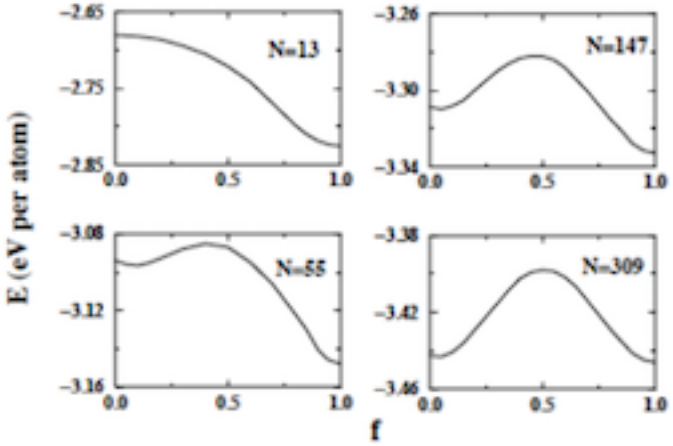
Mohammed A. M. Shtaya-Suleiman in his 2003 Gottingen Dissertation "Size-selective synthesis of nanometer-sized Palladium clusters ..." said:

Table 2. 1. The relation between the number of atoms in a cluster of n shell with the surface atoms N_s and the diameter d.

n	N	N_s	d [nm]
1	13	12	0.70
2	55	42	1.13
3	147	92	1.56
4	309	162	2.00
5	561	252	2.44
6	923	362	2.88
7	1415	492	3.33

"... ...".

C. Barretau, M.C. Desjonqueres, and D. Spanjaard in their paper "Theoretical study of the icosahedral to cuboctahedral structural transition in ... Pd clusters" (Eur. Phys. J. D. 11 (2000) 395-402) said:
"... the icosahedron is the preferred structure at small sizes, and the critical size at which the relative stability becomes favorable to cuboctahedrons is N = 561 for PdN clusters ...[for which]...
For N = 13 the cuboctahedron is ... unstable.
For N = 55, 147, and 309 atoms the cuboctahedron is metastable and slightly distorted ... The evolution of the potential energy profile of homogeneously relaxed ... PdN clusters during the Mackay [Jitterbug] transformation for increasing values of N ...



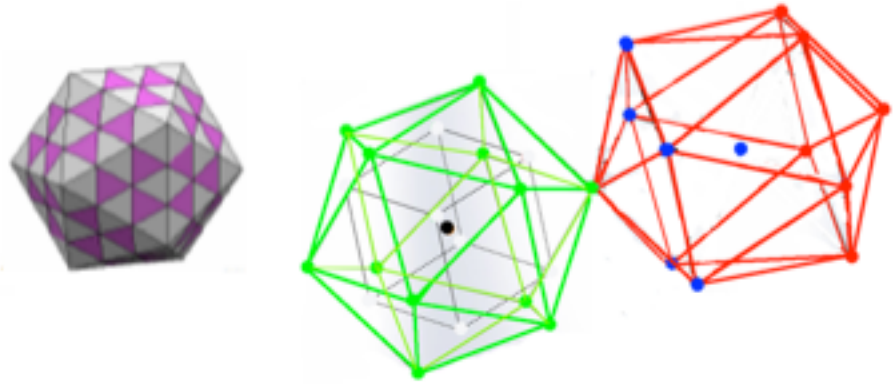
... f is a fraction of the displacements ... f = 0 and 1 correspond to the ... cuboctahedron and icosahedron, respectively ...".

147-atom 1.5 nm Palladium Cluster Crystallite Islands in Pd Film are Optimal for Jitterbug transformation between Icosahedral and Cuboctahedral Configurations.

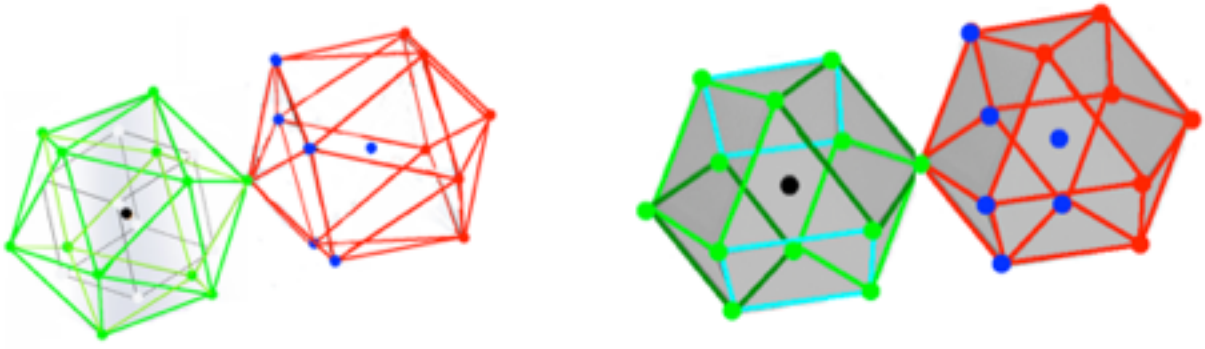
The 13-atom Pd cluster (0.70 nm) is an icosahedron shell around a central atom:

The 2-shell 55-atom Pd/Ni cluster (1.13 nm) is the next level of icosahedral structure. It contains two 13-atom icosahedra that share a central vertex:

The 3-shell 147-atom Pd/Ni cluster (1.56 nm) is the next larger icosahedral structure. It contains 12 exterior 13-atom icosahedra plus 1 central 13-atom icosahedron whose 12 outer vertices are shared, each with one vertex of the 12 exterior icosahedra:



The most stable (lowest Energy per Atom) **Icosahedral Pd cluster is 147-atom**. Since the 147-atom Pd cluster has a metastable cuboctahedral state it can undergo the Jitterbug transformation that is necessary



for Pd-D Jitterbug TSC Schwinger Quantum Fusion (viXra 1502.0248 and 1501.0234v2) .

Can 147-atom 1.5 nm Palladium Cluster Crystallite Islands in Pd Film be used for D Fusion ?

Here is a diagram of a proposed experiment to answer that question:

Based on results of prior experiments by Iraj Parachamazad with Pd in zeolite it might be expected that the Pd Film with 1.5 nm Island Clusters could produce about a kiloWatt per MilliGram of Island Cluster Palladium.