Decay of $^{4}He^{*}$^ from PdD and transmutation

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Present Lochon and Extended-Lochon Models for the low-energy nuclear reaction, LENR, fusion process predict the fusion of monatomic deuterium into a sub-fragmentation level excited condition of $^{4}He^{*}$**^**. The **^** and * indicate the presence of deep-Dirac level (DDL) electrons and of an excited nuclear state respectively.[i] The higher angular-momentum deuterium combinations result in the formation of femto-deuterium molecules or molecular ions, D_2**^** or D_2^{+}**^**. Both the $^{4}He^{*}$**^** and femto-deuterium molecules are expected to be short lived (<1fs). However, the short life may be determined more by their fusion with other nuclei than with their decay time to ^{4}He.

The $^{4}He^{*}$**^** and femto molecules and ions would be highly mobile in the lattice because of their multi-femtometer size. However, because of the Coulomb barrier, the positively charged ion, D_2^{+}**^** or $^{4}He^{*+}$**^,** would not penetrate a nucleus as would the neutral 4He*^ and femto molecule. The positively charged ion would penetrate an atom's electron cloud, but would interact with atoms as would a proton and form a short-lived 'ordinary' molecule, not a femto molecule.

The LENR fusion process for a $^{4}He^{*}$**^** or D_2**^** femto-atom or -molecule, with an atomic nucleus of mass A and charge Z could yield transmutation products ranging from (A, Z-2), by weak-nuclear interaction from (A, Z) absorbing one or two electrons to change protons to neutrons, to (A+4, Z-2), absorbing the whole $^{4}He^{*}$**^** femto-atom. It can also form femto-deuterides, with D_2**^**, or a femto-molecule, with $^{4}He^{*}$**^**. As in the case for ^{1}H**^** or $^{1}H_2$**^** femto-atoms or -molecules generated in NiH cold fusion,[ii] the large number of combinations possible is reduced by the stability 'needs' of the particular atomic nucleus with which the femto-atom/molecule fuses. There is sufficient energy in the process for the conversion of the DDL electron(s) and femto-atom or target-nucleus protons to form neutrons. There are sufficient 'building blocks' with which to 'construct' a stable nucleus from the fusion of almost any nucleus with $^{4}He^{*}$**^** or D_2**^**.
Because of the multi-body interaction, strong near-field radiation from tightly bound electrons, and low input energies, energetic particle emission from fusion with these femto-particles is much less common than for normal fusion or neutron-activation processes. The attraction of femto-atoms or -molecules to radioisotopes[iii] will reduce any radioactivity generated by transmutation of lattice nuclei and fusion with any natural, induced, or added, impurities.

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[i] A. Meulenberg and K. P. Sinha, "Deep-orbit-electron orbits in cold fusion," 17th Int. Conference On Condensed Matter Nuclear Science, Daejeon, Korea, 12-17 August, 2012

[ii] A. Meulenberg, "Femto-molecules and transmutation," 17th International Conference on Condensed Matter Nuclear Science, Daejeon, Korea, 12-17 August, 2012

[iii] A. Meulenberg and K. P. Sinha, "Deep-orbit-electron radiation emission in the decay from 4H*^ to 4He," 17th Int. Conference On Condensed Matter Nuclear Science, Daejeon, Korea, 12-17 August, 2012