Superhyperfine Structure of the Deuteron Line Emission from Active ZrO_2PdD Heralds an FCC Vacancy

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Nanortech, Inc. June 29,2019 ©

Analysis of non-Zeeman superhyperfine line (SHFL) splitting in LANR-induced RF DL-emissions [1] yields insight into the LANR active site not otherwise available [Figure 1]. The SHFL emitted at 327.37 MHz from an active ZrO2PdD component [2] have been analyzed for asymmetry, amplitude and position as a function of frequency. The asymmetry is 7-15% (1st through 3rd closest positions); smaller than the ~50% noted for some Zeeman splittings [3]. Most importantly, the SHFL arise from resonance broadening (RB) which occurs from perturbing deuterons in other vacancies through energy exchange processes. RB impact was derived for the first four closest neighbor sites. The RB interaction decreases as $1/r^3$. Figure 1 demonstrates the better overlap of the expected FCC locations in the midgraph, unlike the BCC lattice. The coordination numbers (CN) also better match for the FCC lattice. Thus, analysis of the CN and RB sideband positions as a function of frequency strongly suggest that the location of the excited state deuterium is a palladium (Pd) vacancy within a slightly modified FCC lattice. The modification shows a multiplet near the second nearest neighbor which might indicate nearby zirconia at a rhombic corner (isoequivalent to a FCC vacancy) or an atom of zirconium (or impurity) within the PdD lattice.

The results in nickel are more complex and demonstrate a range of FCC and body centered cubic (BCC) vacancies, possibly heralding new metallurgic phases. This discovery adds semiquantitative material science support to theories that cite vacancies [4] as the site of the desired LANR reactions.

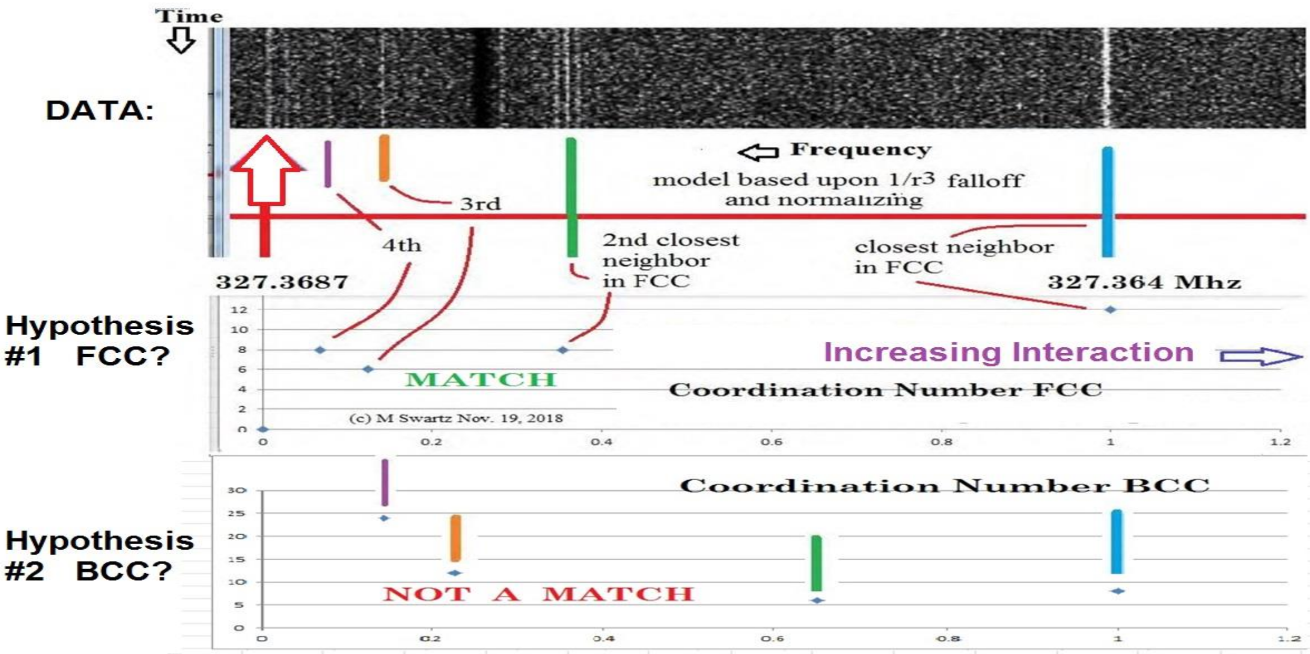

Figure 1 – Lattice Analysis of Active PdD Component's Frequency-Time Plot
This top shows the actual SHFL sideband structure for Nanor®-type component #7-4, driven at ~10 volts. This is a 'waterfall' plot and intensity is shown as a function of frequency. The middle and bottom of the fig. show the expected results for two different gendanken active sites, face and body centered cubic (FCC, BCC) respectively: both the coordination numbers (height) and expected deviation (to the right for frequency).

[1] Swartz M., Atomic Deuterium Produces 327.37 MHz Superhyperfine RF Maser Emission (ICCF-22, 2019)
[2] Swartz M. R., Verner, G., Hagelstein, P., Imaging of an Active NANOR®-type LANR Component using CR-39, J. Condensed Matter Nucl. Sci. 15, (2015), p 81; www.iscmns.org/CMNS/JCMNS-Vol15.pdf
[3] J. E. Mack and O. Laporte, Asymmetric Zeeman Effect Patterns in a Complex Spectrum, Physical Review Journals Archive, Phys. Rev. 51, 291 (February 1937); DOI:https://doi.org/10.1103/PhysRev.51.291.2
[4] Swartz M., Catastrophic Active Medium (CAM) Theory of Cold Fusion, *Proc. ICCF4* 4, (1993), p 255
[5] The author thanks David Nagel, Bo Gardmark, Dennis Craven, Peter Hagelstein, Michael Staker, and Louis Dechiaro