## Hyperfine interactions in Pd foils during D/H electrochemical loading

Eric Bernardo Da Silva[1,2], João Guilherme Correia[3], Michel Zoghby[4], John Gahl[2], Juliana Schell[5], Izabela Teles De Matos[1], Iberê Souza Ribeiro Junior[1], Artur Wilson Carbonari[1], Graham K. Hubler[2], Vittorio Violante[6], Moustapha Thioye[7], Jinghao He[2]

[1]*Instituto de Pesquisas Energéticas e Nucleares, São Paulo University, Brazil*
[2]*University of Missouri, Columbia, USA*
[3]*Div. PH-UIS, ISOLDE-CERN, Geneva, Switzerland*
[4]*Consultant, Thoiry, France*
[5]*Experimentalphysik, Universität des Saarlandes, Germany*
[6]*ENEA, Italian Agency for Energy New Technologies and Sustainable Development, Rome, Italy*
[7]*State University of New York, Stony Brook, USA*

The Fleischmann and Pons Effect (FPE) is the appearance of anomalous excess heat during electrolytic loading of hydrogen in metal. Although observed well above measurement uncertainties [1] this effect still remains unexplained. Unlike previous studies where hydrogen (H) was pre-loaded before Time Differential Perturbed Angular Correlations (TDPAC) [2,3] was performed, this present work probes, at the nanoscopic scale, palladium (Pd) samples during H and deuterium (D) loading in 0.1M LiOH or LiOD electrolyte. Radioactive $^{181}$Hf ($^{181}$Ta) was implanted at 80 keV (HISKP-Bonn) and experiments were performed at the ISOLDE-CERN SSP laboratories after vacuum annealing to recover implantation defects. An almost "flat" unperturbed PAC – R(t) spectrum was observed, as expected for Hf/Ta atoms at cubic Pd sites with no remaining point defects in their vicinity. Upon D loading the "flat" unperturbed R(t) spectrum changes to a characteristic Gaussian-like EFG distribution, centered near zero EFG, due to the random distribution of D atoms inside the Pd lattice. With increasing D concentration, the central value of the distribution becomes nonzero, thus revealing that the Pd crystalline structure is relaxed from cubic, consistent with the phase diagram for Pd hydrides. The data also shows that, while being an impurity in the system under study, the Hf/Ta atoms do not trap nor significantly interfere with the H/D atoms in the Pd lattice that would bias the present studies. Thus, further experiments aimed at studying the FPE under external excitations are envisaged.

[1] G. K. Hubler, Surf. Coatings Tech. 201, 8568.s (2007)
[2] J. Trager, M. Karger, T. Butz, F. E. Wagner, Hyp. Int. 16, 795-800 (1983)
[3] G. Schatz and A. Weidinger, Nuc. Cond. Matt. Phy., John Wiley&Sons (1996)