



The anomalous heat effect on D/H loaded Palladium

Exploration at an atomic level, preliminary perturbed angular correlations studies

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The Sidney Kimmel Institute for Nuclear Renaissance (SKINR) was created in 2012 at the University of Missouri to perform fundamental research on the fact that excess heat is sporadically produced during electrolysis of heavy water on Pd cathodes. We call this phenomenon, discovered in 1989, the *anomalous heat effect* (AHE) since its origin is unknown. This talk will begin with presentation of the landscape of the field of AHE as it is today, review anomalous heat data, and discuss why local scale – atomic scale – methods are essential, looking forward, to understand the phenomena going on. In this context we expect that perturbed angular correlations (PAC) data may provide clues that would aid developing a model for AHE.

The second part of the presentation covers ENEA's research of the material science of cathode preparation, pre and post materials analyses, and status of the cathode during excess heat production.

The third part of the presentation will review our recent preliminary *in-situ* PAC measurements performed at the SSP labs at ISOLDE during the electrolysis in 0.1 M LiOH or LiOD for ¹⁸¹Hf implanted Pd cathodes at the BONIS – HISKP Bonn separator. The data for LiOD electrolyte show anomalous, variable high frequency electric field gradient (EFG) components that appear / disappear near specific loading ratio of D/Pd that is not evident for LiOH electrolyte. This high frequency component does not appear in static samples so it may be attributed to the dynamics of D loading at the 30 nm implantation depth of the Hf. Details of the data analysis and possible explanations will be discussed, as well as possible complementary experiments to further elucidate the findings.

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