Positronium Emission from Materials for Li-ion Batteries

A Bernardo Barbiellini[1,2*], Jan Kuriplach[3]
[1]School of Engineering Science, LUT university, Lappeenranta 53851, Finland
[2]Department of Physics, Northeastern University, Boston, Massachusetts 02115, USA
[3]Department of Low Temperature Physics, Faculty of Mathematics and Physics, Charles University, V Holešovičkách 2, CZ-180 00 Prague, Czech Republic
bernardo.barbiellini@lut.fi

A positron and an electron annihilate into gamma-ray photons but before this annihilation, the positron and an electron can bind together to form a positronium (Ps). Mono-energetic positron beams can be used to bombard materials and to probe their atomistic properties. In particular, the implanted positron can diffuse back to the surface of a solid and be emitted as Ps with a range of kinetic energies that provides key information regarding the energy levels of the electrons in the material. These energies can be measured by time of flight (TOF) experiments, but the Ps lifetime before annihilation has been too short for precise measurements. Recently, Jones et al. [1], by exciting the emitted Ps with a laser to greatly increase its lifetime, obtained TOF measurements with an ultimate precision of the order of 5 meV that will allow materials simulations in systems pertinent for Li-ion batteries cathodes [2,3].

References

[1] A. C. L. Jones, H. J. Rutbeck-Goldman, T. H. Hisakado, A. M. Piñeiro, H. W. K. Tom, A. P. Mills, Jr. , B. Barbiellini, J. Kuriplach, *Phys. Rev. Lett*., **117**, (2016), 216402.
[2] B. Barbiellini, J. Kuriplach, *Journal of Physics: Conf. Series*, **791**, (2017), 012016.
[3] J. Kuriplach, A. Pulkkinen, B. Barbiellini, arXiv:1904.12212.