O2 |

Positron analysis of right- and left-handed alanine single crystals

J.D. Van Horn[1,*], B. Eren[2], F. Wu[1], E. Eren[2] and Y.C. Jean[1]

[1]*Department of Chemistry, University of Missouri-Kansas City, 5110 Rockhill Rd., Kansas City, Missouri 64110 USA*
[2]*Department of Chemistry, Faculty of Science and Arts, Bilecik Şeyh Edebali University 11210 Bilecik, Turkey*

[*]email: vanhornj@umkc.edu

Studies of the interaction of polarized light or particles (including electrons, e^-, or positrons, e^+) with asymmetric forms of matter has been of interest to scientists since the discovery of chirality and of particle physics. Researchers have been interested in e^+ interactions with chiral molecules for decades, but with indecisive results [*e.g.* 1, 2]. After reviewing the field, we speculated that the e^+ or positronium (Ps) might interact differently with chiral pairs of large enantiomeric single crystals—*i.e.* LH and RH asymmetric forms—and found significant differences in "free positron" annihilation and intensities in evaluating L and R quartz crystals [3]. To extend this line of research we crystallized large D- and L-alanine crystals and performed PALS measurements using a Na-22 positron source.

Alanine crystals were obtained via slow evaporation of water in a Dewar, or from water/acetone solvent in a temperature-controlled environment (Fig. 1). These methods resulted in small (~0.5 cm^3) or large (> 1.0 cm/side) crystals, respectively. Intensity (I_2) results from LH and RH crystals were different in PALS analysis (*e.g.* Fig. 1, right). Aspects of asymmetric crystals, stereo-recognition, and stereo-selection will be discussed, as well as prior positron experiments with asymmetric forms of matter. The result here may be considered a follow-up study and extension of early work by Garay, *et al.* [4], Rich [5], and others over the years investigating the PAS of D- and L-amino acids.

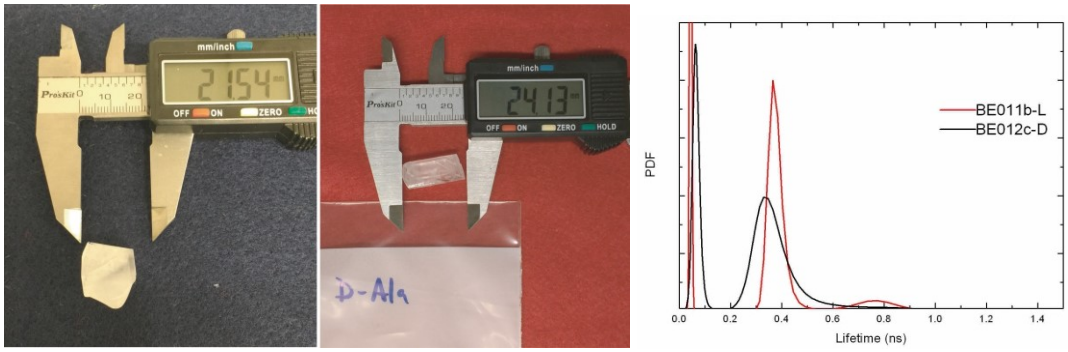

Fig.1. Examples of large L- and D-alanine crystals. MELT analysis of PALS data for small (~0.5 cm) L- and D-alanine crystals.

[1] Y.C. Jean and H.J. Ache. *J. Phys. Chem*. 81, 1157 (1976)
[2] L. Chiari, A. Zecca, S. Girardi, A. Defant, F. Wang, X.G. Ma, M. V. Perkins and M.J. Brunger, *Phys. Rev. A*, 85, 052711 (2012)
[3] J.D. Van Horn, F. Wu, G. Corsiglia and Y.C. Jean, *Defect. Diffus. Forum*. 373, 221 (2016)
[4] A.S. Garay, L. Keszthekyi, I. Demeter and P. Hrasko, *Nature* 250, 332 (1974)
[5] A. Rich, *Nature* 264, 482 (1976)