

## Para-positronium in polymers and silica glass

Y. Kobayashi,<sup>1\*</sup> K. Sato<sup>2</sup>, M. Yamawaki<sup>3</sup>, T. Oka,<sup>4</sup> and M. Washio<sup>1</sup>

<sup>1</sup>Research Institute for Science and Engineering, Waseda University,  
Shinjuku, Tokyo 169-8555, Japan

<sup>2</sup>Department of Environmental Sciences, Tokyo Gakugei University,  
Koganei, Tokyo 184-8501, Japan

<sup>3</sup>National Institute of Advanced Industrial Science and Technology,  
Tsukuba, Ibaraki 305-8565, Japan

<sup>4</sup>Department of Excellence in Higher Education and Department of Chemistry, Tohoku  
University, Sendai, Miyagi 980-8578 & 8576, Japan

It is possible to deduce the  $S$  parameter associated with the pick-off annihilation of ortho-positronium (o-Ps) in polymers and SiO<sub>2</sub>, providing unique information on the electrons participating in the pick-off annihilation process, by positron-age momentum correlation (AMOC) spectroscopy [1]. In the present study, we attempted to estimate the  $S$  parameter relevant to para-positronium (p-Ps) and discuss its implication to the self-annihilation of p-Ps.

From the time dependence of the overall  $S$  parameter,  $S(t)$ , obtained from the AMOC spectra of polymers and SiO<sub>2</sub> reported in [1], the  $S$  parameter associated with p-Ps,  $S_{p-Ps}$ , was evaluated. In doing so, the lifetime and yield of o-Ps were fixed respectively to the lifetime and relative intensity of the longest-lived component observed for the same materials by positron lifetime spectroscopy. The p-Ps yield was fixed to one third of the relative intensity of the longest-lived component.

Prior to the annihilation, positronium (Ps) in polymers and SiO<sub>2</sub> is thought to localize in a sub-nanometer space. The pick-off annihilation lifetime of o-Ps is determined by the size of this sub-nanometer space. According to the study of silica glasses with different compositions by Angular Correlation of Annihilation Radiations (ACAR) [2], the momentum distribution of p-Ps also depends on the size of the sub-nanometer hole. We compared  $S_{p-Ps}$  obtained by AMOC spectroscopy with the  $S$  parameter expected for p-Ps localized in a hole and found that they agree with each other for polymers such as polyethylene, polystyrene etc. However, for some polymers and SiO<sub>2</sub>  $S_{p-Ps}$  is far less what is expected for p-Ps localized in a hole, suggesting p-Ps annihilating prior to thermalization.

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### References

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\*Corresponding author, Email: yoshi-kobayashi@aoni.waseda.jp