# Positron annihilation induced Auger electron spectroscopy (PAES) measurements of a $TiO_2$(110) surface

A. J. Fairchild,[1*] V. A. Chirayath[1], R. W. Gladen[1], A. R. Koymen[1], and A. H. Weiss[1]

[1]*Department of Physics, University of Texas at Arlington, 502 Yates St., Arlington, Texas 76019, USA*

Recently Tachibana et al. [1] found that positron induced $O^+$ desorption ($e^+$SD) from $TiO_2$ was enhanced in comparison to electron induced $O^+$ desorption for incident particles in the energy range from 10 eV to 600 eV. They proposed that this enhancement was due to the annihilation of surface trapped positrons with inner shell electrons [1]. Here we report measurements of positron induced electron emission from a $TiO_2$(110) surface which may provide insights into the desorption process. The energy of the positron induced electrons were measured using its time of flight, which is taken as the time difference between the detection of the annihilation gamma and the positron induced electron. The positron induced electron spectrum [Fig.1] exhibit relatively narrow peaks at ~ 260 eV and ~ 500 eV corresponding to Auger transitions initiated by the annihilation of 1s electrons in carbon and oxygen respectively. The most significant feature of the spectrum is a broad low energy peak extending from ~ 2 eV to ~ 15 eV. Since the incident positron beam energy (3 eV) was well below the energy necessary to directly knock out electrons of these energies, the peak must be due to an annihilation induced process. The origin of this low energy peak in terms of Auger processes resulting from the annihilation of positrons with deep valence and shallow core levels in $TiO_2$, and the possible importance of such processes to $e^+$SD will be discussed.

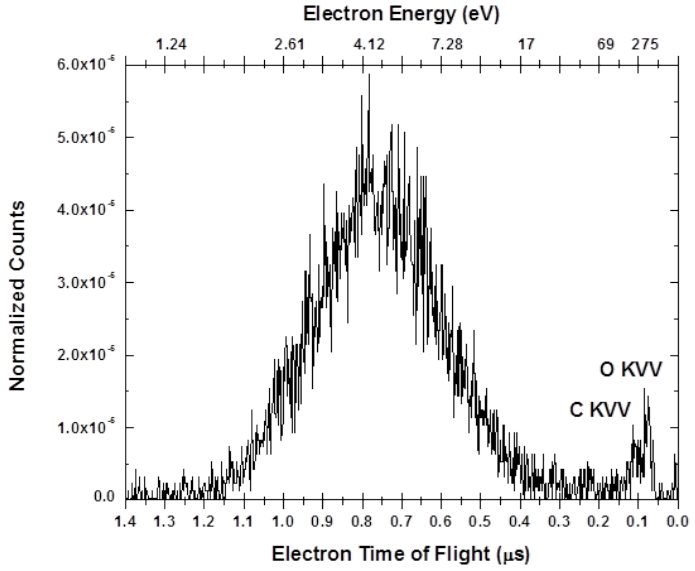


**Figure 1** *Positron annihilation induced Auger electron spectrum (PAES) from a $TiO_2$(110) surface. Core KVV Auger peaks corresponding to 1s Auger transitions in carbon and oxygen are present alongside a broad low energy peak. This spectrum was measured using a positron beam energy of 1 eV and a sample bias of -2 V.*

**References**

[1] T. Tachibana et al., Sci. Rep. 1, 1-3 (2018).

*Corresponding author, Email: alexander.fairchild@uta.edu