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Positron Annihilation Spectroscopy of High Performance Polymer Films under CO_2 Pressure C.A. QUARLES, Texas Christian University, JOHN R. KLAEHN, ERIC S. PETERSON, Idaho National Laboratory, JAGODA M. URBAN-KLAEHN, Pajarito Scientific Corporation — Positron annihilation lifetime and Doppler broadening measurements are reported for six polymer films as a function of carbon dioxide (CO_2) absolute pressure ranging from 0 to 45 psi. Since the polymer films were thin and did not absorb all positrons, corrections were made in the lifetime analysis for the absorption of positrons in the positron source and sample holder using the Monte Carlo transport code MCNP. Some polymers studied form positronium and others, such as the polyimide structures, do not. For those polymers that form positronium an interpretation in terms of free volume is possible; for those that don't form positronium, further work is needed to determine how best to describe the behavior in terms of the bulk positron annihilation parameters. A few of the studied polymers exhibit changes in positron lifetime and intensity under CO_2 pressure which may be described by the Henry or Langmuir sorption models, while the positron response of other polymers is rather insensitive to the CO_2 pressure. The results demonstrate the usefulness of positron annihilation spectroscopy in investigating the sorption of CO_2 into various polymers.

Carroll Quarles
Texas Christian University

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