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Detecting nothing with anti-electrons

Positrons, the antiparticles to electrons, are ideal probes to detect missing atoms in solids. This has been used successfully to detect open volume from vacancies on up to large voids and mesopores in materials. This presentation will provide an overview of the capabilities of positron annihilation spectroscopy as a depth selective probe to observe vacancies and mesopores sizes and size distributions in materials relevant to a broad range of fields. Layers in microelectronics offer the opportunity to lower the dielectric properties of insulators and hence increase the signal propagation speed. Pores and their interconnectivity are vital to filtration, reverse osmosis for food and drug delivery as well as clean water. They are key for catalytic processes in zeolites as well as for ion transport in the operation of batteries. With a mono-energetic beam of positrons, these features can be characterized as a function of depth below the surface down to several 10 s of micrometers, ideal for thin films and layers. On the missing atomic level, positrons are attracted electrostatically to vacancies and vacancy clusters by the small attractive potential formed due to the absence of the positively charged atom core. Measurements are capable of detecting vacancy concentrations at one in one million atoms level. This presentation will focus on the capabilities at the positron beam at Washington State University. Capabilities will be illustrated with a number of examples.

Biography

Marc H Weber completed his PhD in “Positrons (antiparticles of electrons) interacting with single crystal surfaces” from City College of City University of New York. He is a Research Professor at Washington State University and has worked on “Positron in atomic physics, high energy physics and materials science”.

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