

Abstract Submitted
for the APR10 Meeting of
The American Physical Society

The Effects of Fluid Absorption on the Mechanical Properties of Joint Prostheses Components DAVID YARBROUGH¹, ANN VIANO, Rhodes College — Ultra-high-molecular-weight polyethylene (UHMWPE) is the material playing the role of cartilage in human prosthetic joints. Wear debris from UHMWPE is a common reason for joint arthroplasty failure, and the exact mechanism responsible for wear remains an area of investigation. In this study, the microstructure of UHMWPE was examined as a function of fluid absorption. Samples with varying exposure to e-beam radiation (as part of the manufacturing process) were soaked for forty days in saline or artificial synovial fluid, under zero or 100 lbs load. Samples were then tensile-tested according to ASTM D-3895. The post-stressed material was then examined by transmission electron microscopy to evaluate the molecular response to stress, which correlates with macroscopic mechanical properties. Three parameters of the crystalline lamellae were measured: thickness, stacking ratio, and alignment to stress direction. Results indicate that fluid absorption does affect the mechanical properties of UHMWPE at both the microscopic and macroscopic levels.

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Date submitted: 23 Oct 2009

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