

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Structural and chemical changes in ultra-high-molecular-weight polyethylene due to gamma radiation-induced crosslinking and annealing in air . ANN VIANO, KARYN SPENCE¹, MATTHEW SHANKS, M. ANDREW SCOTT, RICHARD REDFEARN, CARL CARLSON, TERESE HOLM², Rhodes College, ASIT RAY, Christian Brother's University — Ultra-High-Molecular-Weight-Polyethylene (UHMWPE) is used to fabricate one of the articulating surfaces used in many total joint replacements. Various sterilization and annealing methods affect the mechanical wear properties in ways still unknown at the microscopic and molecular levels. We have investigated crosslinking induced by gamma irradiation and annealing time (both done in air). TEM was used to probe the organization of crystalline lamellae in the polymer. Pyrolysis interfaced with GC-MS was used to quantify the extent of crosslinking by identifying peaks that correlate with crosslinking structures along its backbone. Changes in lamellar stacking and the extent of the crosslinking suggest two types of crosslinking occurring in the material. Lamellar mobility is enhanced during the transitions from one type of bonding to the other, and this appears to optimize near eight hours of annealing time. Results from decomposition experiments and percent crystallinity measurements provide further support for this postulated theory.

¹currently at Washington University

²currently at The University of Arizona

Ann Viano
Rhodes College

Date submitted: 12 Jan 2006

Electronic form version 1.4