Contribution ID: **403** Type: **Oral**

Radiation Induced Oxidation, Cross-Linking and Grafting of Ultra-High Molecular Weight Polythylene

Friday, 28 April 2017 12:25 (10 minutes)

Ultra-high molecular weight polyethylene (UHMWPE) has excellent chemical inertness, biocompatibility, mechanical property and wear-resistance, which is widely used in engineering and medical fields. Some drawbacks of UHMWPE need overcome by radiation processing, such as poor compatibility, creep-resistance and yield strength. In this work, radiation oxidation and grafting were adopted to modify the surface property of UHMWPE. Radiation cross-linking and annealing were used to improve the creep-resistance, yield strength and wear resistance of UHMWPE. The results indicated that radiation oxidation and grafting could effectively change chemical groups on the surface of UHMWPE. However, radiation oxidation could not remarkably improve the surface property of UHMWPE, such as hydrophilicity, even at a dose of 300 kGy by gamma irradiation in air [1]. Radiation grafting of acrylic acid could significantly improve the hydrophilicity of the UHMWPE powder. The UHMWPE powder with grafting yield of less than 10% presented a good dispersion in water. Radiation cross-linking and annealing improved creep-resistance and yield strength of the UHMWPE sheets. The cross-linked UHMWPE sheet with a dose of 300 kGy was without obvious deformation under a load of 0.06 MPa at 270 ℃ in 4 h [2]. In addition, the cross-linked UHMWPE powder as an additive, even at low content, could improve the wear resistance of pristine UHMWPE. In conclusion, the surface and mechanical properties of UHMWPE can be effectively improved by radiation processing.

Country/Organization invited to participate

China

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Session Classification: A15

Track Classification: RADIATION SYNTHESIS AND MODIFICATION OF MATERIALS