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Influence of transporting discharge and plasma gun on surface modification of UHMWPE film and HDPE tube

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Ultra-high- molecular-weight polyethylene (UHMWPE) has been widely used because of its excellent mechanical properties but is often unsuitable for use due to its poor wettability. Plasma treatment is a promising technique that enables the surface modification of polymers without affecting the bulk material characteristics. In the present work, the helium transporting discharge and plasma gun were applied to improve the surface properties of UHMWPE films and HDPE tubes. Surface morphology and chemical compositions were performed by means of FTIR, AFM, XPS, and contact angle measurements with the aim of understanding the surface modification effects. The single plasma jet covers only a few square millimeters, which makes it difficult for large-scale treatment of the film surface. To overcome this challenge, we have considered the use of plasma gun arrays consisting of many individual jets placed within close proximity of each other, such structure has a potential to greatly enhance the scale of surface treatment as compared to that of a single plasma jet. FTIR and XPS analyses, indicated that helium plasmas introduced mainly oxygen containing functional groups but also unsaturation has also been observed which has been reported to take place at the same time as surface crosslinking of the UHMWPE. The AFM observations show a surface smoothening with different plasma treatment configurations. Furthermore the stability of the surface properties of the UHMWPE was studied by the measure of the water contact angle. According to our results, transporting discharge and plasma gun have a potential to enhance the surface activation of inner walls of tubes and UHMWPE films. This can be very interesting for biomedical applications such as tissue tolerable polymers, inner walls of vascular grafts and catheters, etc.

Keywords

transporting discharge

plasma gun

UHMWPE

surface modification