
INFLUENCE OF SiO₂ MICRO-PARTICLES ONTO MICROSTRUCTURE, MECHANICAL PROPERTIES AND WEAR RESISTANCE OF UHMWPE BASED COMPOSITE UNDER DRY SLIDING FRICTION

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Abstract. This research investigated the influence of silicon dioxide (SiO₂) with particle size of 5 micron on microstructure, mechanical properties and wear resistance of UHMWPE polymeric composite materials under dry sliding friction that was tested by Block-on-ring technique according to ASTM G77. Bulk UHMWPE composite specimen was reinforced with SiO₂ particles by weight fraction of 0.1, 0.2, 0.3, 0.4, 0.5, 1, 2, 3, 4 and 5 wt.%. Specimen was performed by hot compression process with the compression forming conditions at the temperature of 202.11°C, pressure of 9.73 MPa and exposure time of 76.97 minutes. It was found that, SiO₂ has the potential to cause cross-linking in the molecular chain of polymers and affect in increased crystallinity and density. For the case of the microstructure, SiO₂ particle fraction in the range of not more than 0.5 wt.% did not effect to change microstructure of the specimen which Its microstructure did not significantly different from the pure UHMWPE specimen due to SiO₂ particle was dispersed uniformly in the UHMWPE matrix. Its microstructure appeared in a lamellar form or flake pattern. However, the increasing of SiO₂ more than 0.5 wt.% effect to changed microstructure due to the increased SiO₂ particles separated from the matrix and accumulation at the grain boundary of UHMWPE powder particles. For the case of mechanical and wear resistance properties, the increasing of SiO₂ particle of 1 wt.% affect to increased various mechanical properties to have a maximum value and decreased wear rate to minimum value of $5.10 \times 10^{-11} \pm 1.26 \times 10^{-11} \text{ mm}^3/\text{Nm}$. After that, the increasing of SiO₂ particle effect to decreased mechanical and wear resistance properties except for the hardness that continuously increased according to the increasing of SiO₂.