

Supplementary

# Structural, Mechanical, and Tribological Properties of Oriented Ultra-High Molecular Weight Polyethylene/Graphene Nanoplates/Polyaniline Films

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**Citation:** Dayyoub, T.; Maksimkin, A.; Olifirov, L.K.; Chukov, D.; Kolesnikov, E.; Kaloshkin, S.D.; Telyshev, D.V. Structure, Mechanical and Tribological Properties of Oriented Ultra-High Molecular Weight Polyethylene/Graphene Nanoplates/Polyaniline Films. *Polymers* **2023**, *15*, x. <https://doi.org/10.3390/xxxxx>

Academic Editor(s): Amitesh Maiti

Received: date

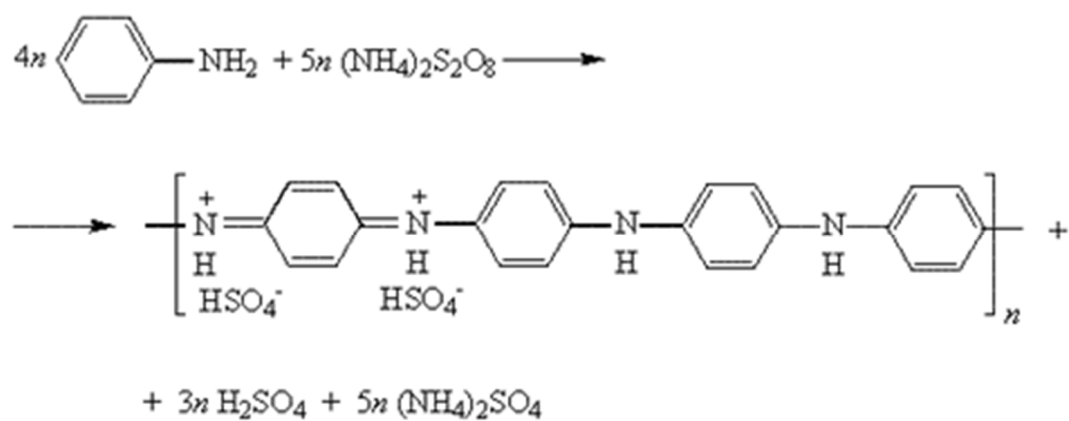
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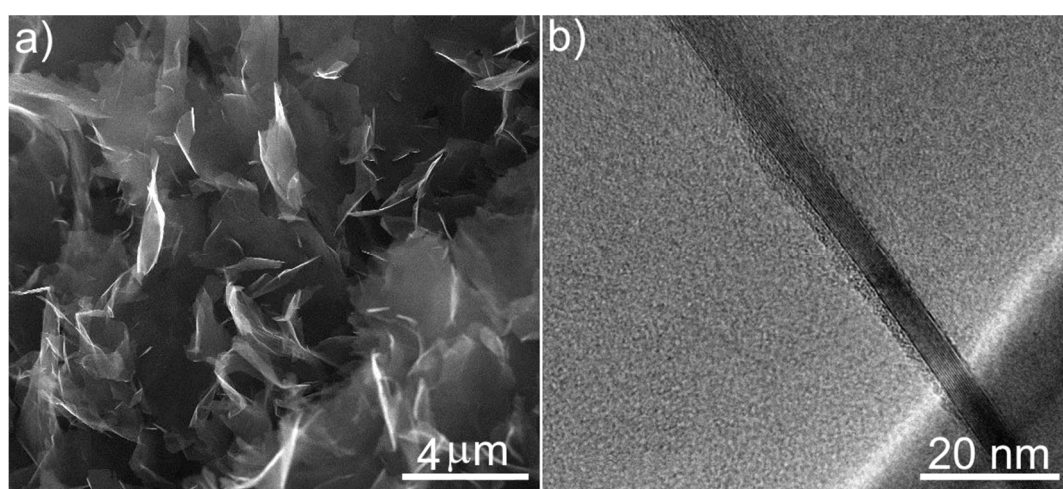
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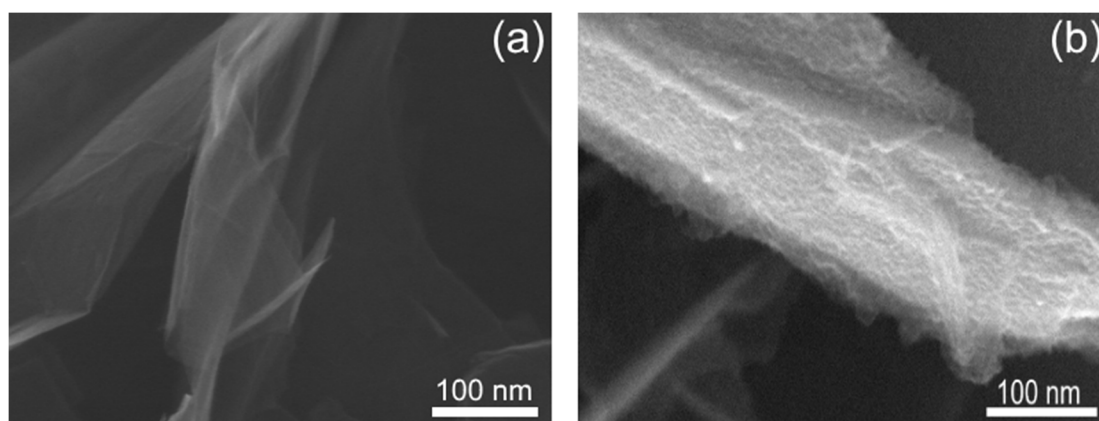
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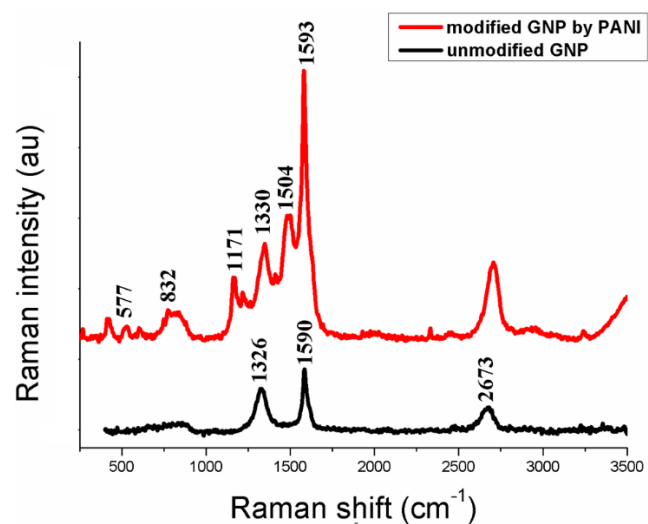
**Figure S1.** The scheme of oxidative polymerization of aniline [20].



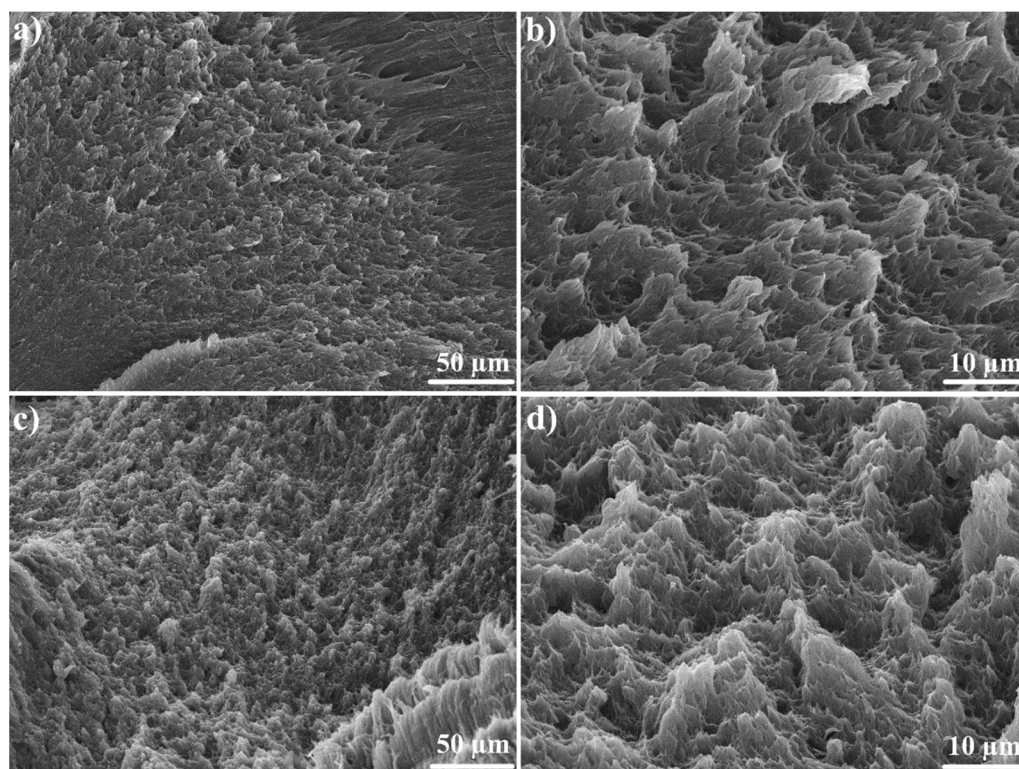
**Figure S2.** (a) SEM and (b) TEM micrographs of GNP microstructure [20].



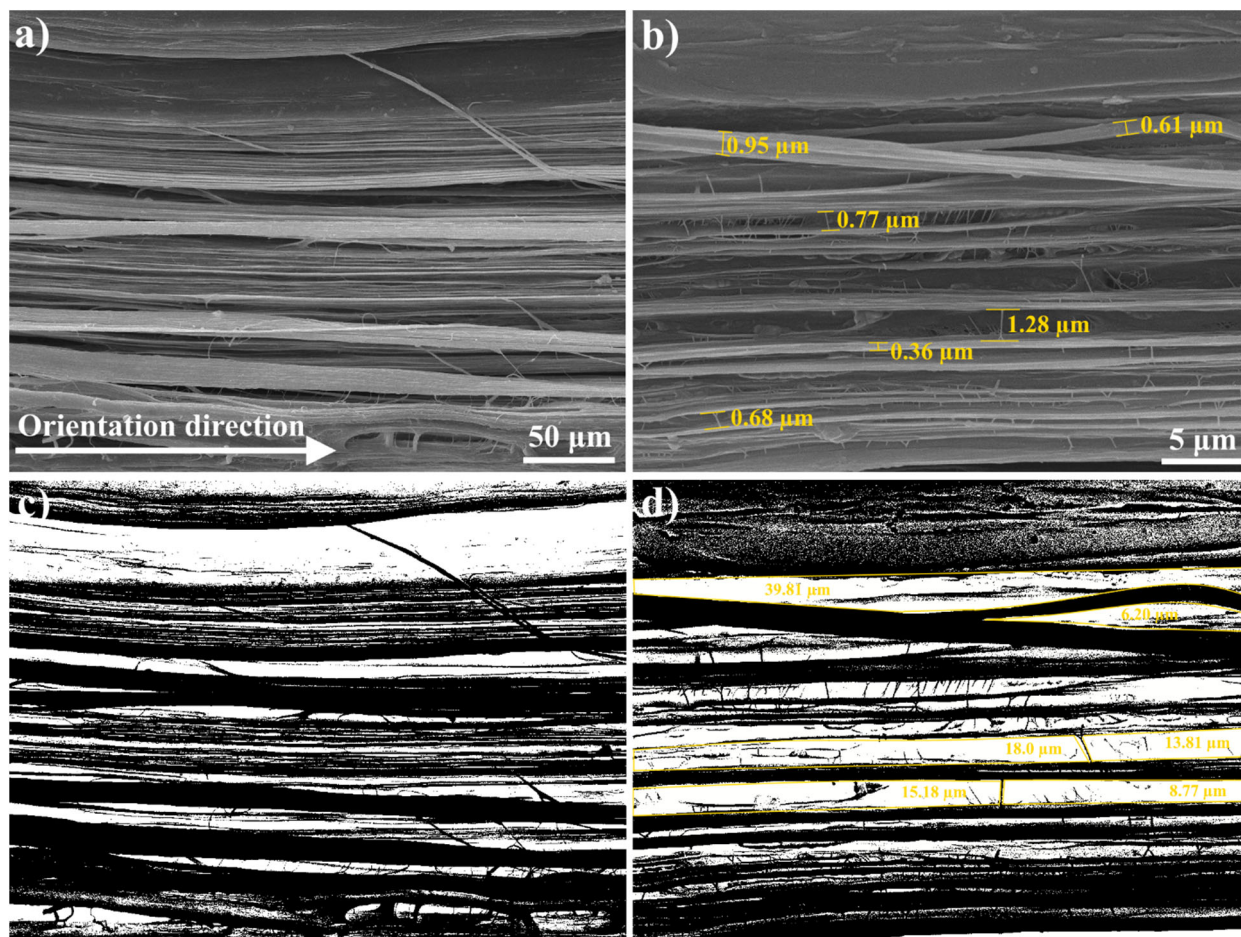
**Figure S3.** SEM micrograph of the (a) unmodified GNP and (b) modified GNP by PANI [20].



**Figure S4.** Raman spectra of (a) unmodified GNP and (b) modified GNP by PANI [20].



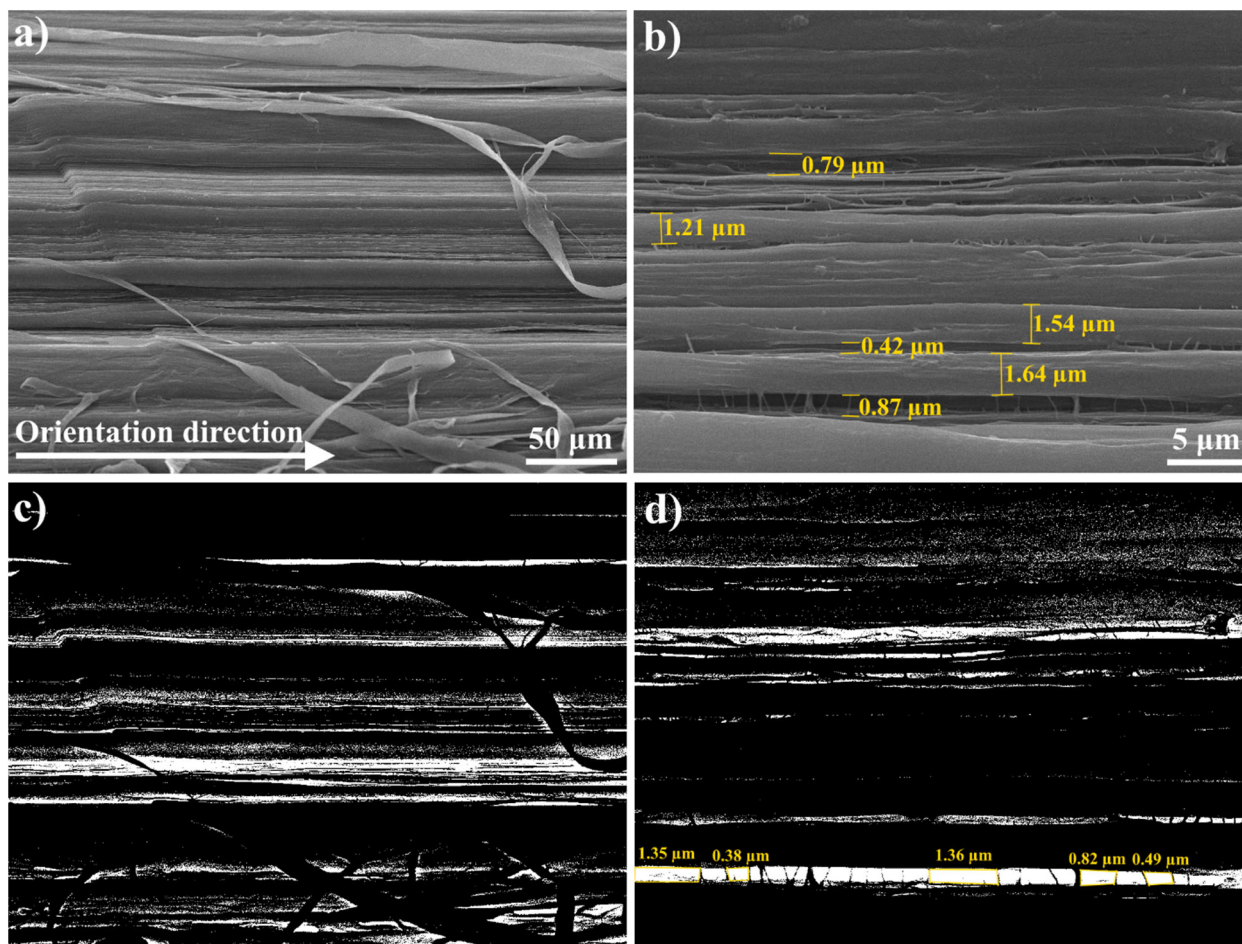
**Figure S5.** SEM micrographs showing typical supra-molecular structure of (a, b) UHMWPE /1.0 wt. % PE-wax/ 0.01 wt. % GNP/PANI, and (c, d) UHMWPE /1.0wt. % PE-wax/ 2.0 wt.% GNP/PANI xerogels.



**Cavitation area in percentage =  $38 \pm 2$  %**

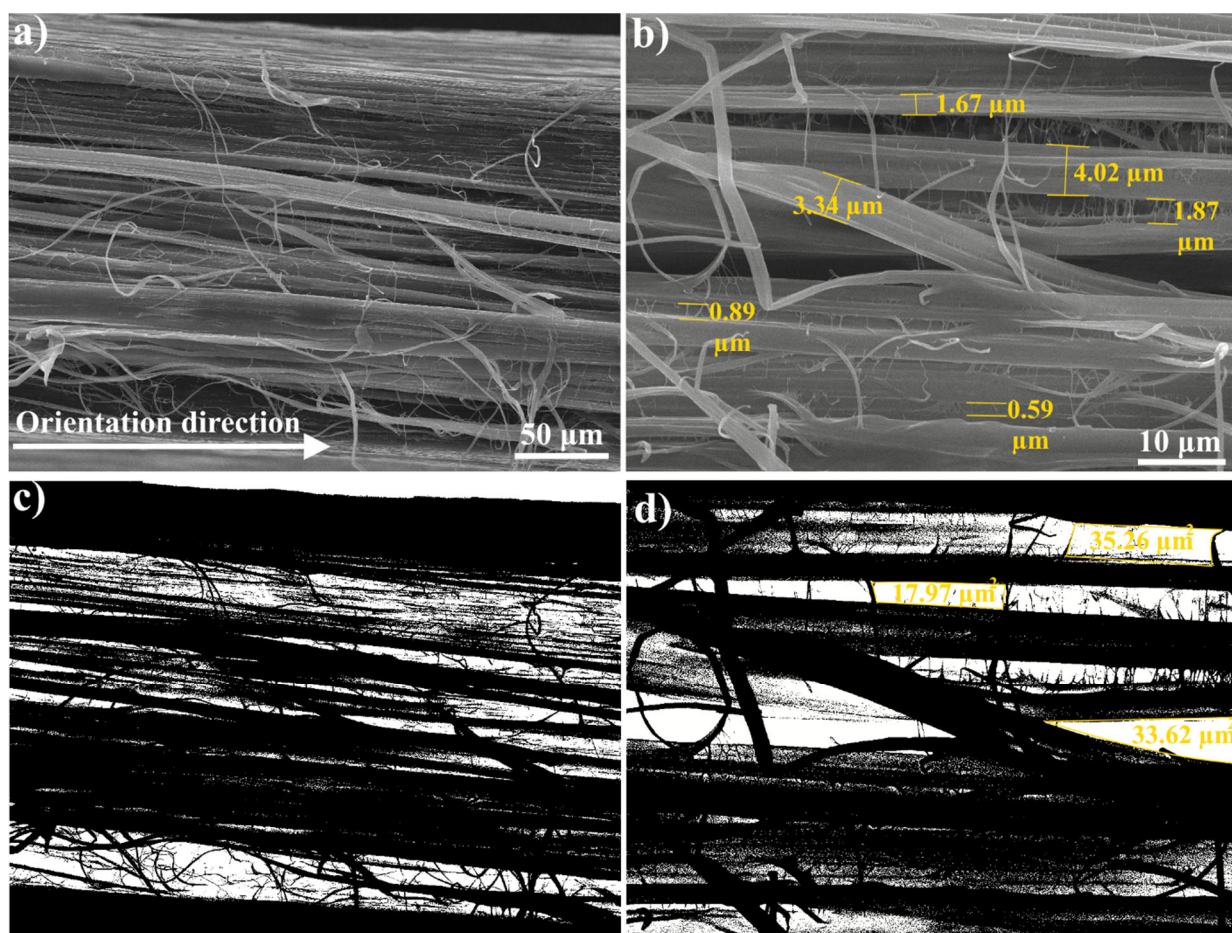
**Figure S6.** SEM micrographs of fibrillar structure for virgin UHMWPE films obtained by first thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $1.2 \pm 0.2$   $\mu\text{m}$ .





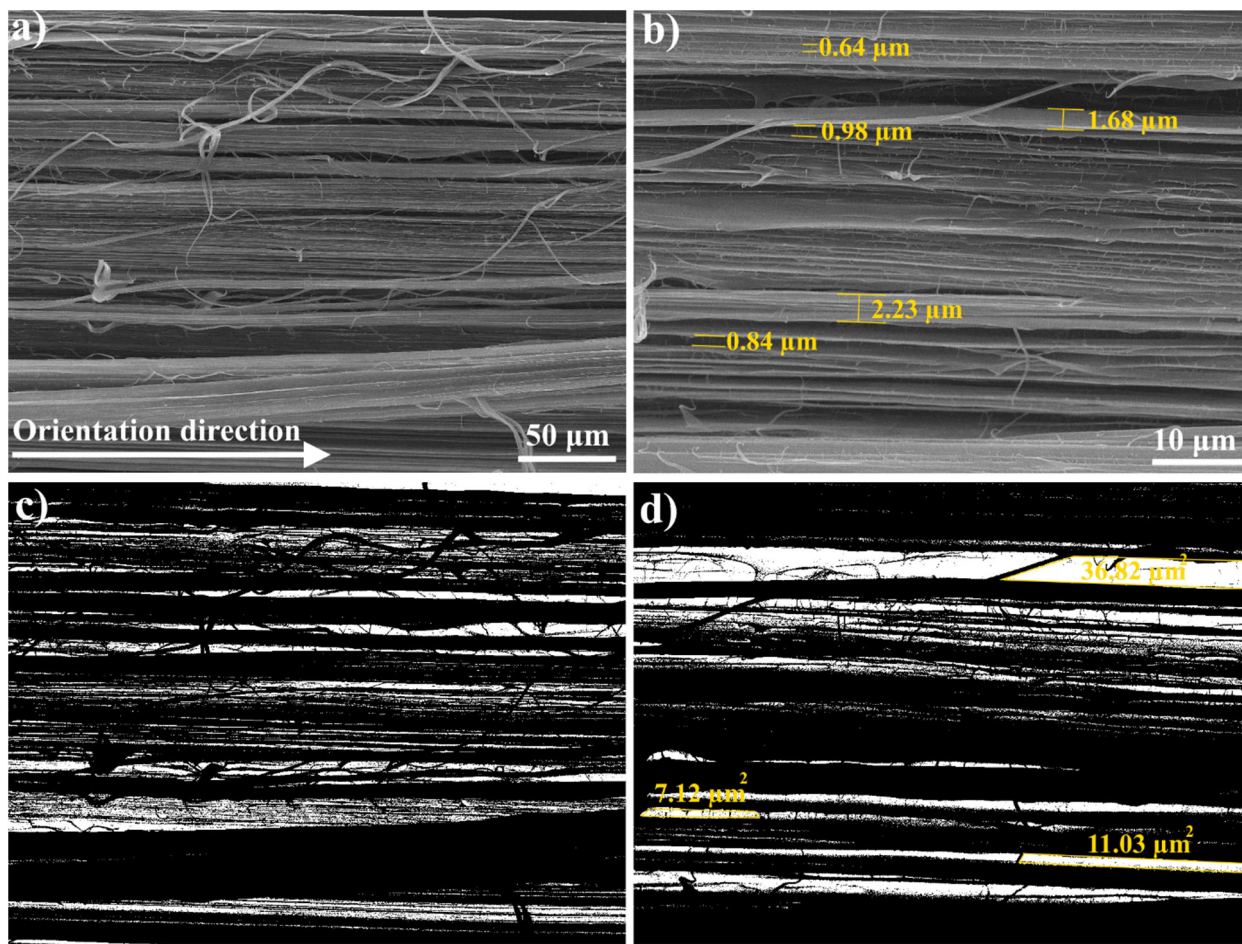
**Cavitation area in percentage =  $10 \pm 1$  %**

**Figure S7.** SEM micrographs of fibrillar structure for UHMWPE/1.0 wt. % PE-wax films obtained by first thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $0.8 \pm 0.2$  μm.



**Cavitation area in percentage =  $22 \pm 2$  %**

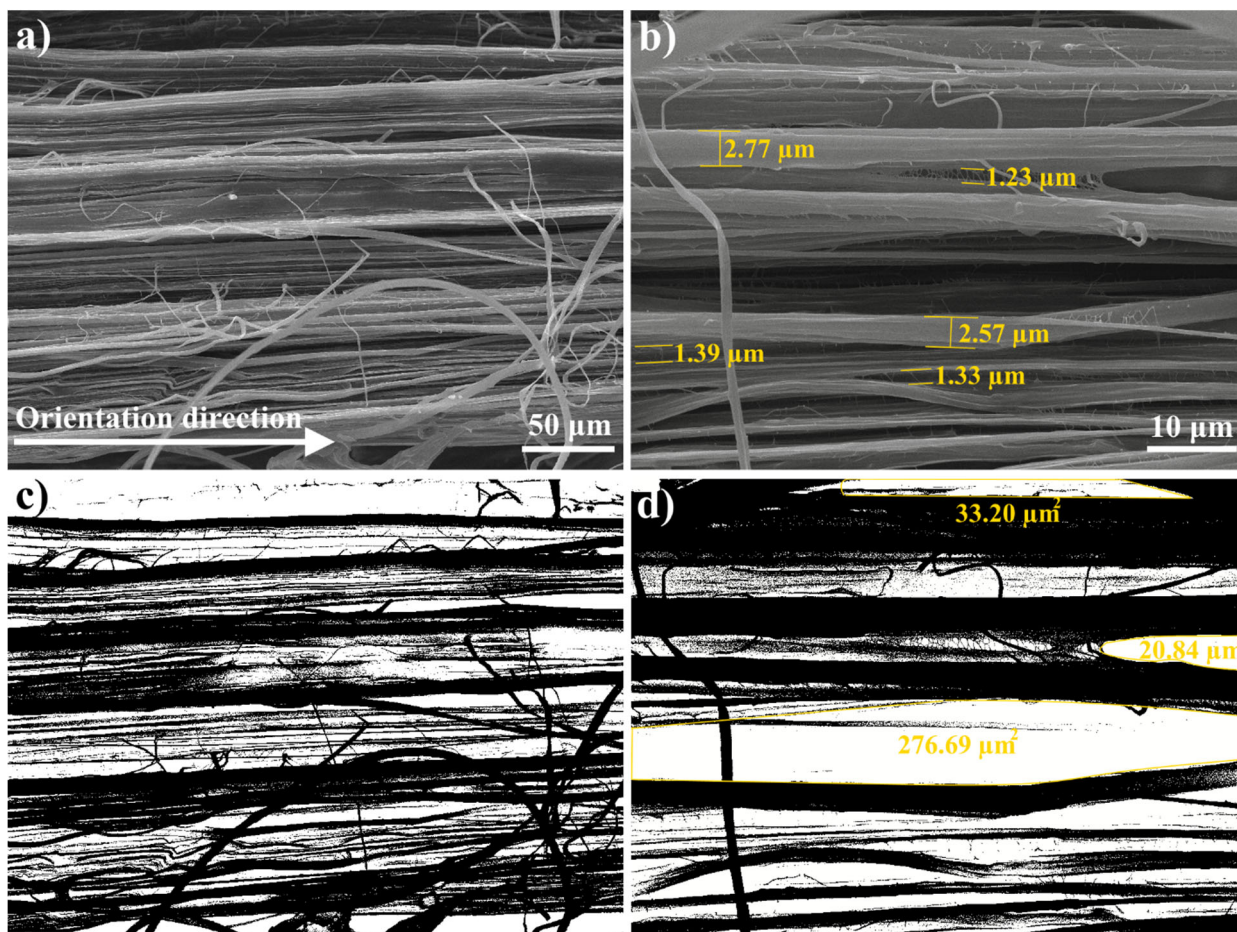
**Figure S8.** SEM micrographs of fibrillar structure for UHMWPE /1.0 wt. % PE-wax/ 0.01 wt. % GNP/PAN films obtained by first thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $3.4 \pm 0.5$   $\mu\text{m}$ .



**Cavitation area in percentage =  $17 \pm 1$  %**

**Figure S9.** SEM micrographs of fibrillar structure for UHMWPE /1.0 wt. % PE-wax/ 0.01 wt. % GNP/PAN films obtained by second thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $1.8 \pm 0.2$  μm.

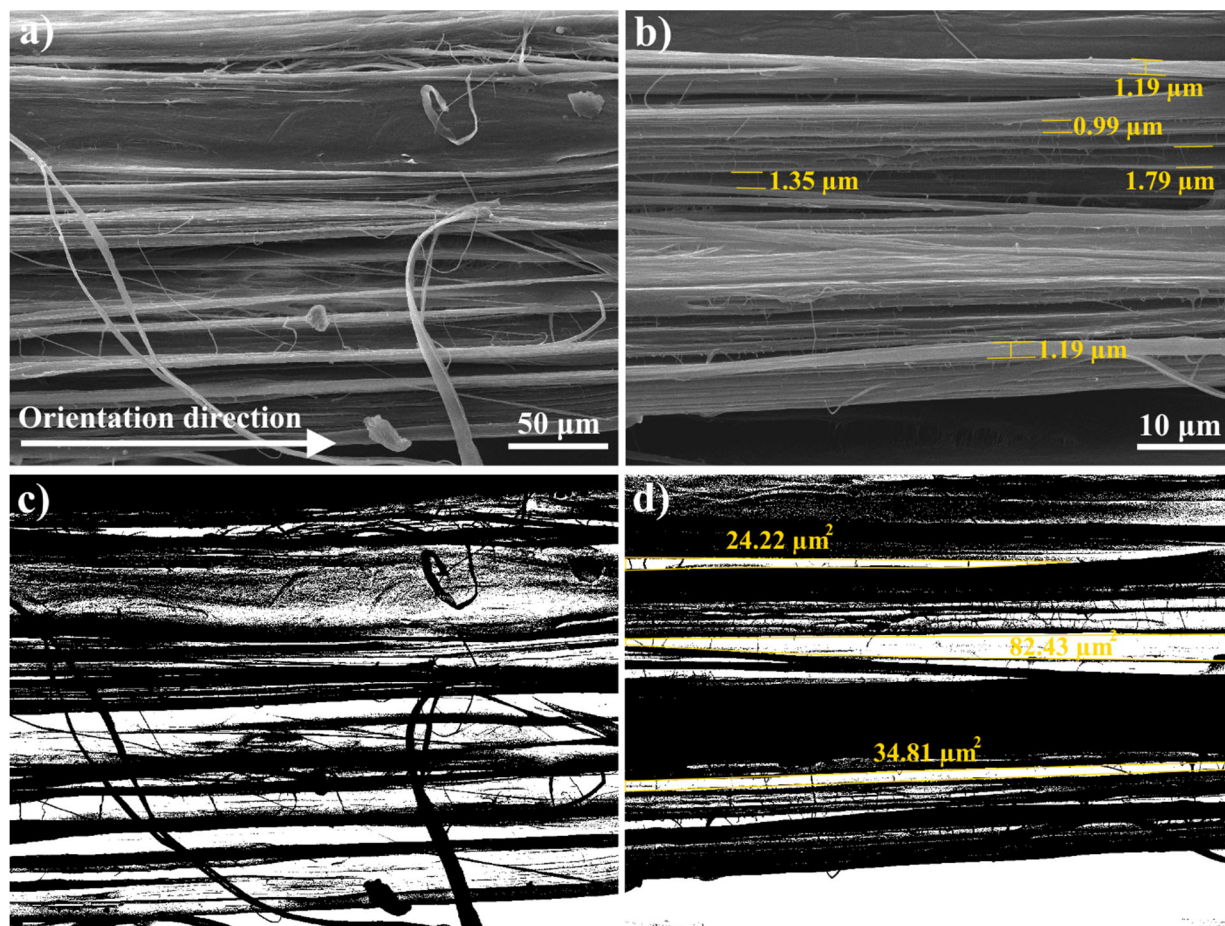




**Cavitation area in percentage =  $42 \pm 1$  %**

**Figure S10.** SEM micrographs of fibrillar structure for UHMWPE /1.0 wt. % PE-wax/ 2.0 wt. % GNP/PANI films obtained by first thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $3.7 \pm 0.4$  μm.





**Cavitation area in percentage =  $34 \pm 2$  %**

**Figure S11.** SEM micrographs of fibrillar structure for UHMWPE /1.0 wt. % PE-wax/ 2.0 wt. % GNP/PAN films obtained by second thermal orientation regime (a, b), (c, d) modified SEM images using the image J program. The average pore size is  $2.2 \pm 0.3$  μm.