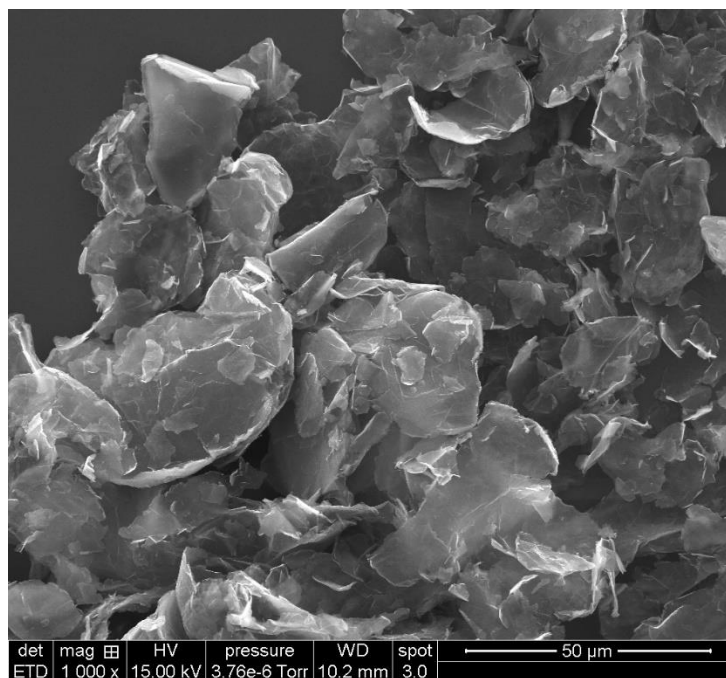
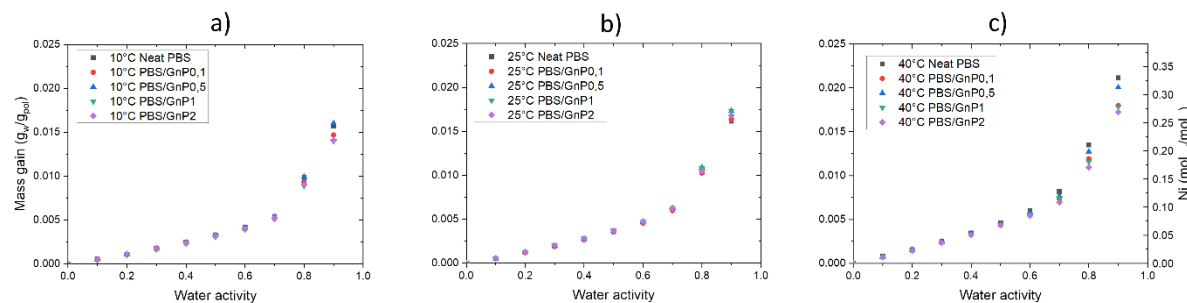


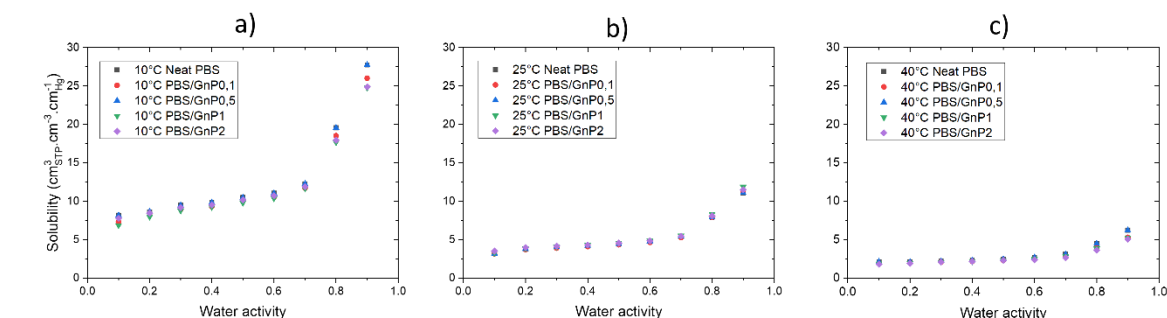
## Supplementary Materials



**Figure S1:** Scanning electron micrographs of GnP particles.

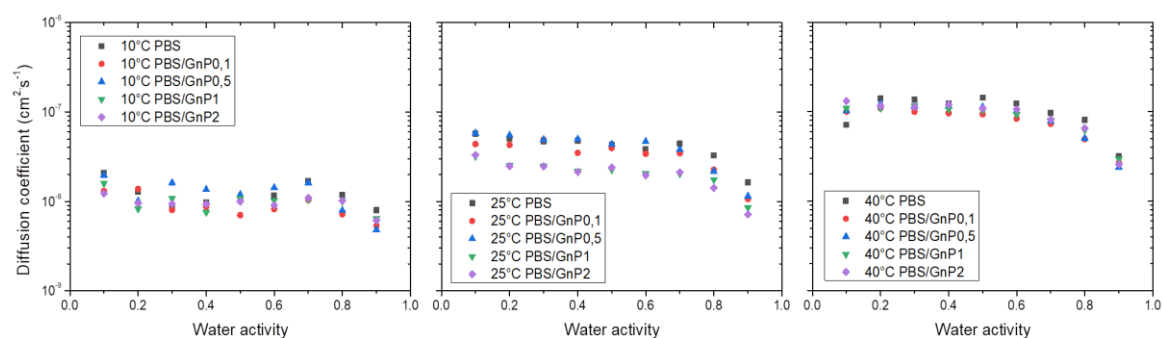


**Figure S2:** Mass gain (X-axis) and number of average number of water molecules sorbed in a single amorphous unit of polymer ( $\bar{N}$ ) (Y-axis) at a) 10 °C, b) 25 °C and c) 40 °C for neat PBS and corresponding nanocomposites.

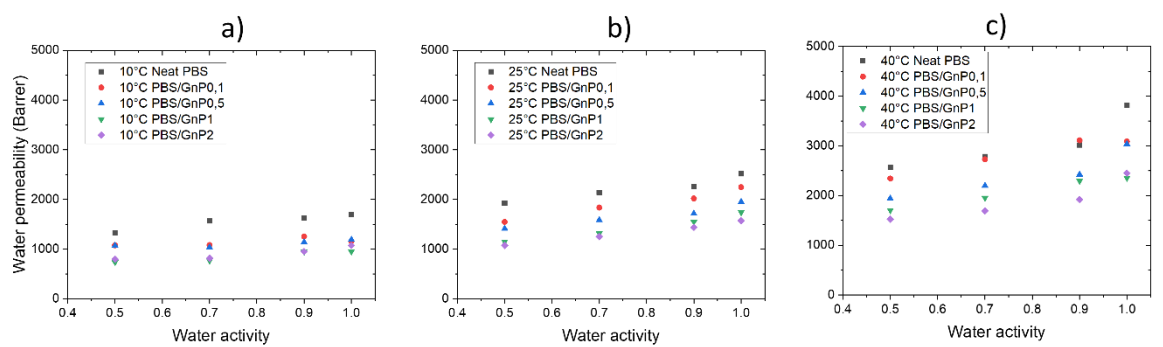


**Figure S3:** Solubility coefficient at a) 10 °C, b) 25 °C and c) 40 °C for neat PBS and corresponding nanocomposites.

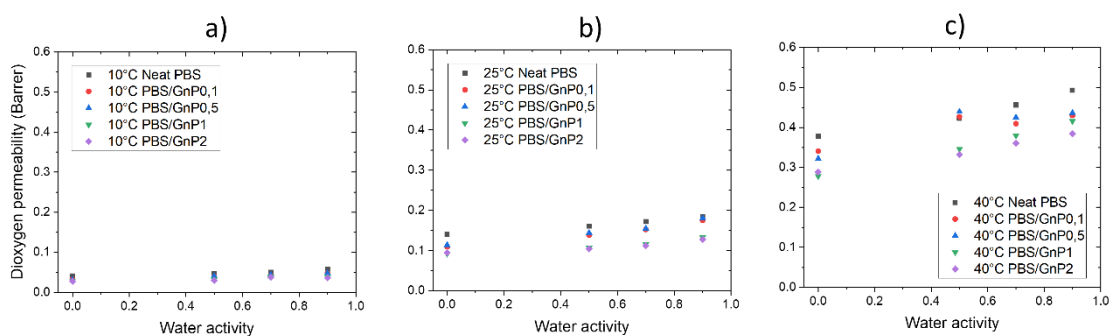




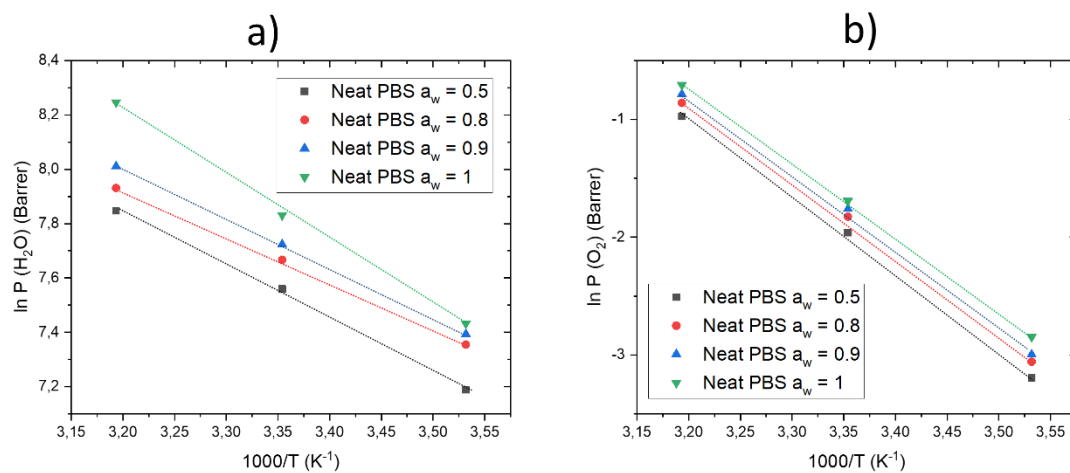
**Figure S7: Diffusion coefficient at a) 10 °C. b) 25 °C and c) 40 °C for neat PBS and corresponding nanocomposites.**



**Figure S8: Water permeability coefficient at a) 10 °C. b) 25 °C and c) 40 °C for neat PBS and corresponding nanocomposites.**



**Figure S9: Dioxygen permeability coefficient at a) 10 °C. b) 25 °C and c) 40 °C for neat PBS and corresponding nanocomposites.**



**Figure S10: a) Arrhenius plot used to calculate a)  $E_p$  H<sub>2</sub>O and b)  $E_p$  O<sub>2</sub> for neat PBS for some water activities.**