

### Oxygen diffusion through PVA/graphene oxide thin films

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We investigated the oxygen diffusivity and solubility in polymer/graphene thin films. Smoluchowski equation was solved to interpret the reduced diffusivity and solubility. In this study, poly(vinyl alcohol) (PVA)/graphene oxide (GO) nanocomposites were made by a modified Hummers method and a solution mixing method. We reveal that the GO is fully exfoliated in the PVA/GO nanocomposites. We show that GO is itself a good gas barrier. We also demonstrated that the oxygen permeability of PVA/GO coated film containing 0.3wt.% is 17 times lower than that of the pure PET film with 93% light transmittance at 550nm. PVA/reduced GO (RGO) nanocomposites were made by chemical reduction using hydrazine monohydrate. The oxygen permeability of PVA/RGO coated film containing 0.3wt.% GO is 86 times lower than that of the pure PET film. Both the diffusivity and solubility are reduced by dispersing RGO into PVA. However, only the solubility is reduced when GO is dispersed in PVA. The Nielsen approximation for the tortuosity of the gas diffusion path was compared to the results. The diffusivity of the PVA/RGO composite follows the Nielsen approximation, but those of the PVA/GO composite do not follow.