

Polymeric mixed matrix membranes with enhanced water vapor separation

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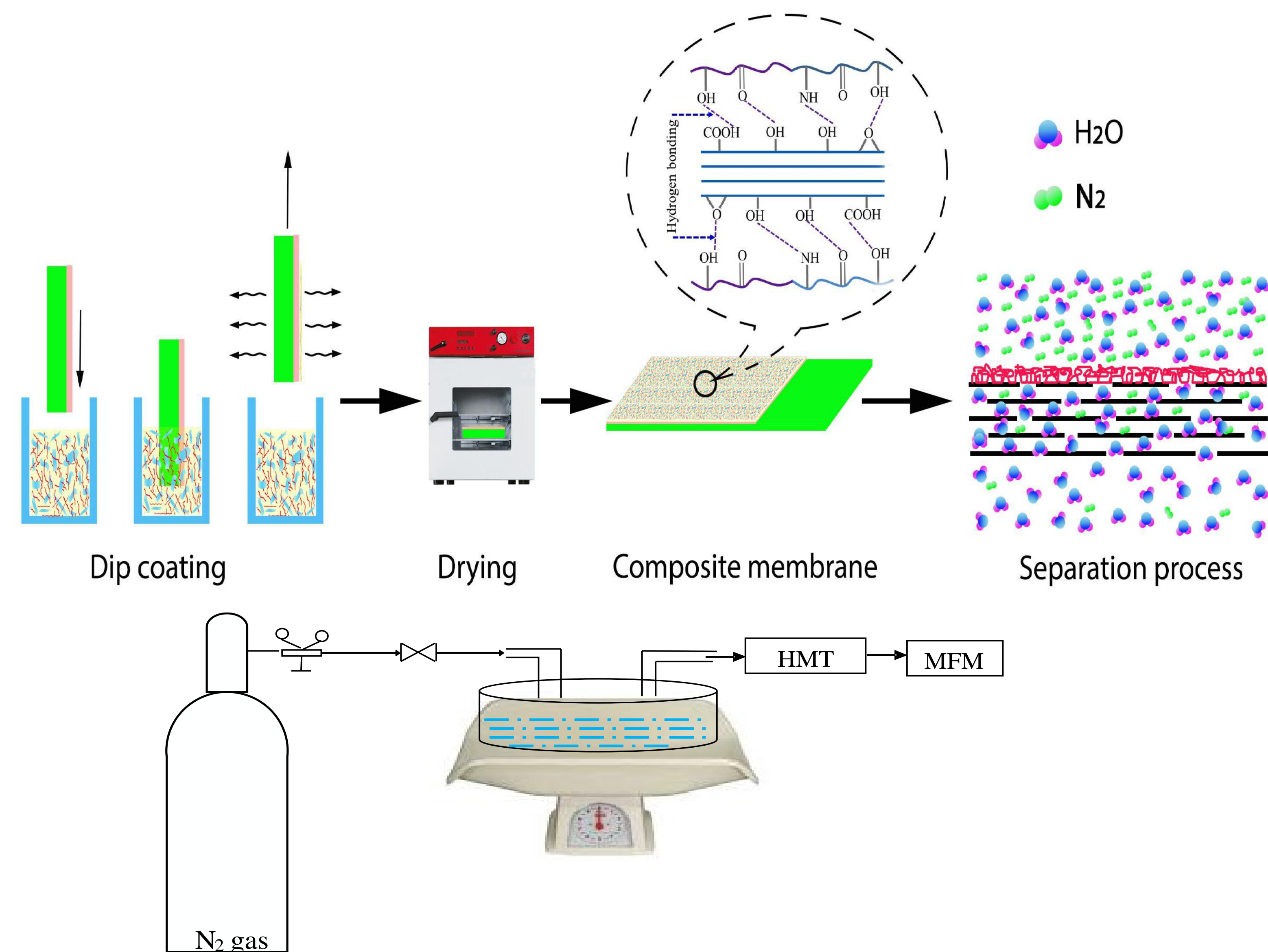
Achievement: Composite membranes with Pebax® 1657 and graphene oxide nanosheets were successfully fabricated. Addition of graphene oxide nanosheets decreased the water vapor flux only slightly whereas the H₂O/N₂ selectivity increased by 50%.

Introduction

Polymeric membranes are used in the selective removal of water vapor from humid streams for dehydration or dehumidification applications. These unique characteristics can be enhanced and tailored for desired applications by adding graphene oxide nanosheets to the selective layer. Some of the potential benefits are:

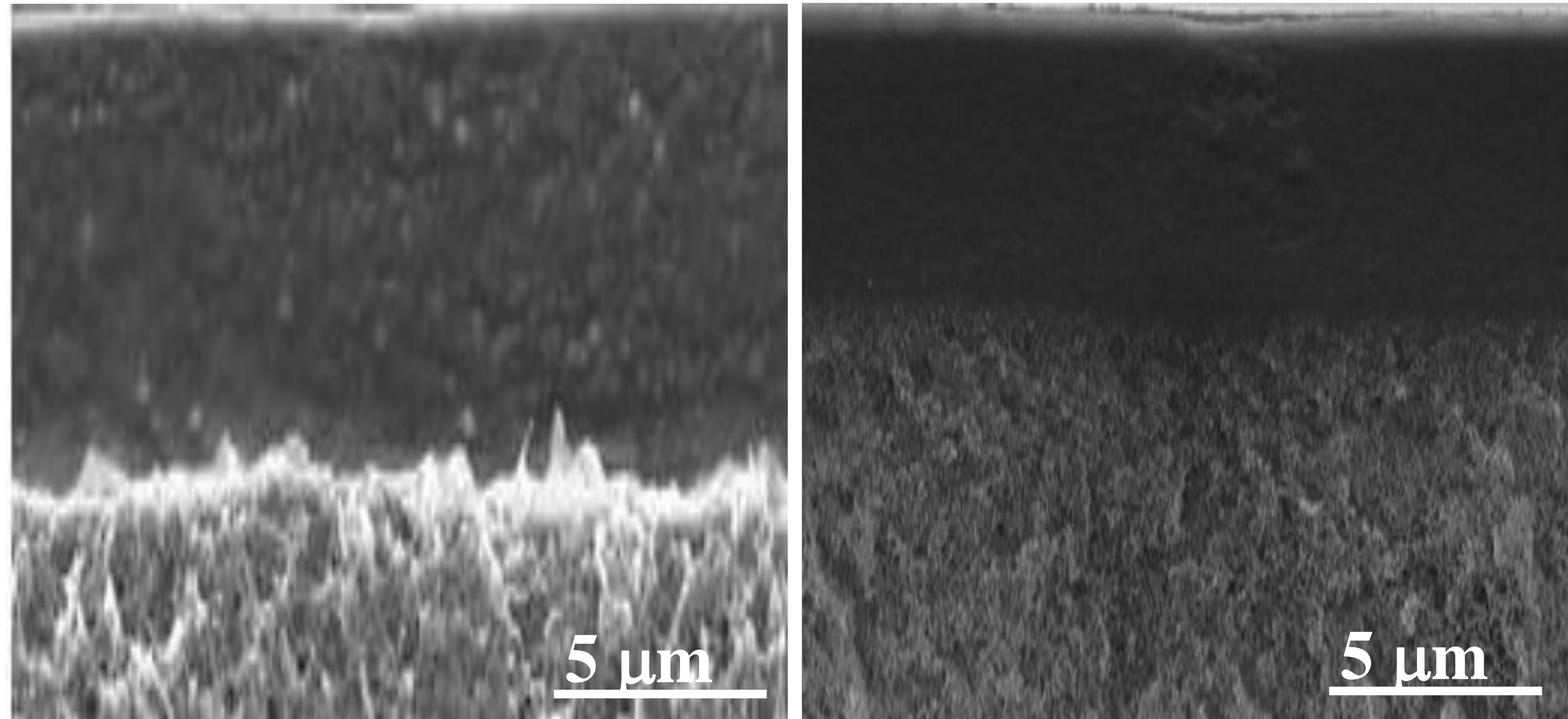
- Uniform dispersion of nanosheets into the polymer matrix hence avoiding agglomeration
- Improvement in water vapor/N₂ selectivity without losing much flux
- Mechanical stability enhancement with the composite membranes

Our approach



Characterization

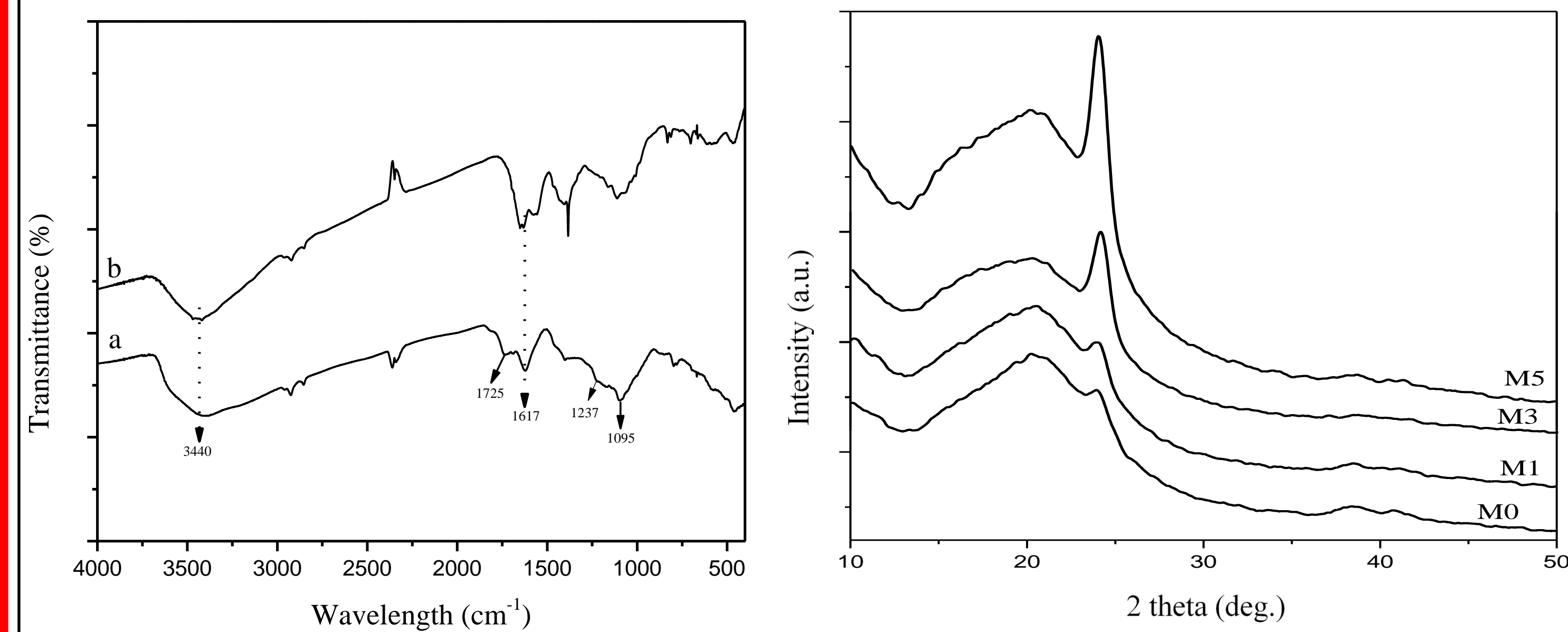
Uniform defect free distribution of GO nanosheets



Composite membrane with Pure Pebax® 1657

Composite membrane with 2 wt% GO nanosheets

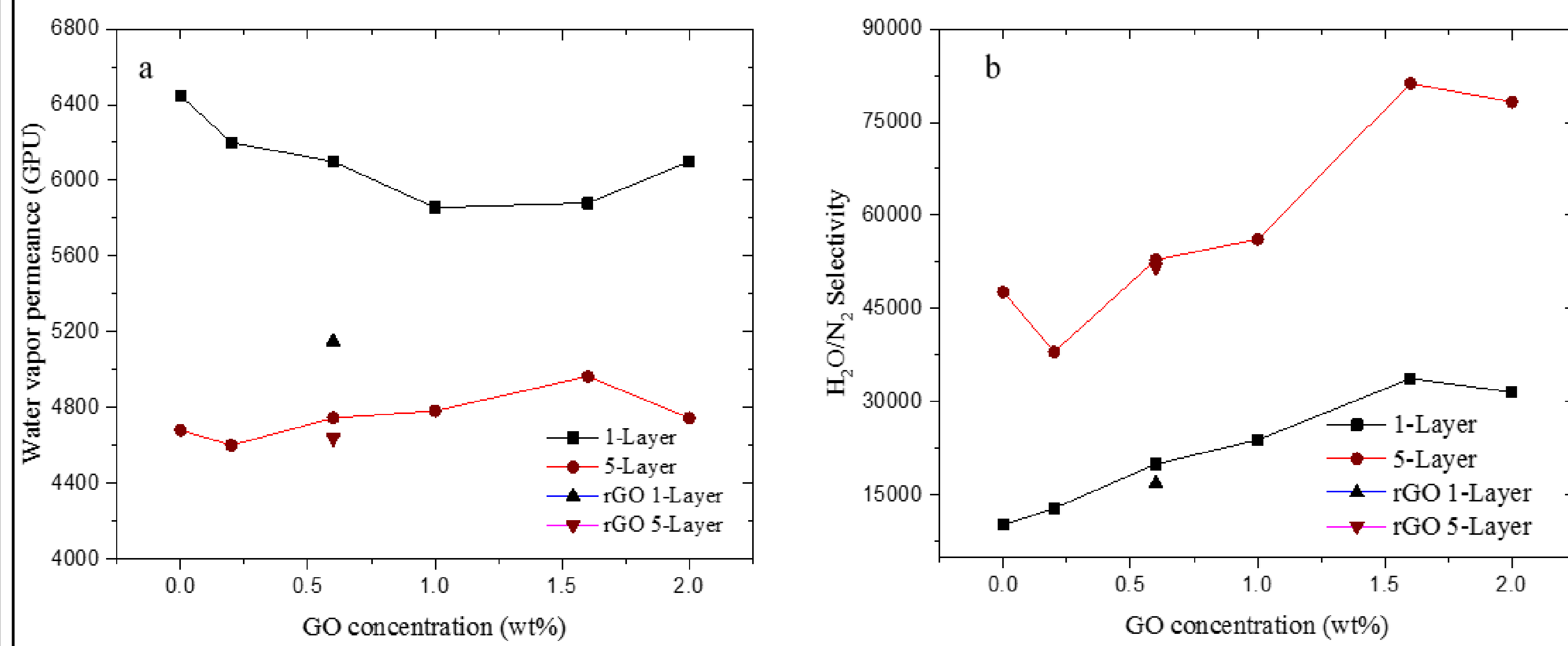
Good adherence between the rubbery polymer and the GO nanosheets entrapped through hydrogen bonding interactions among oxygen containing functional groups.



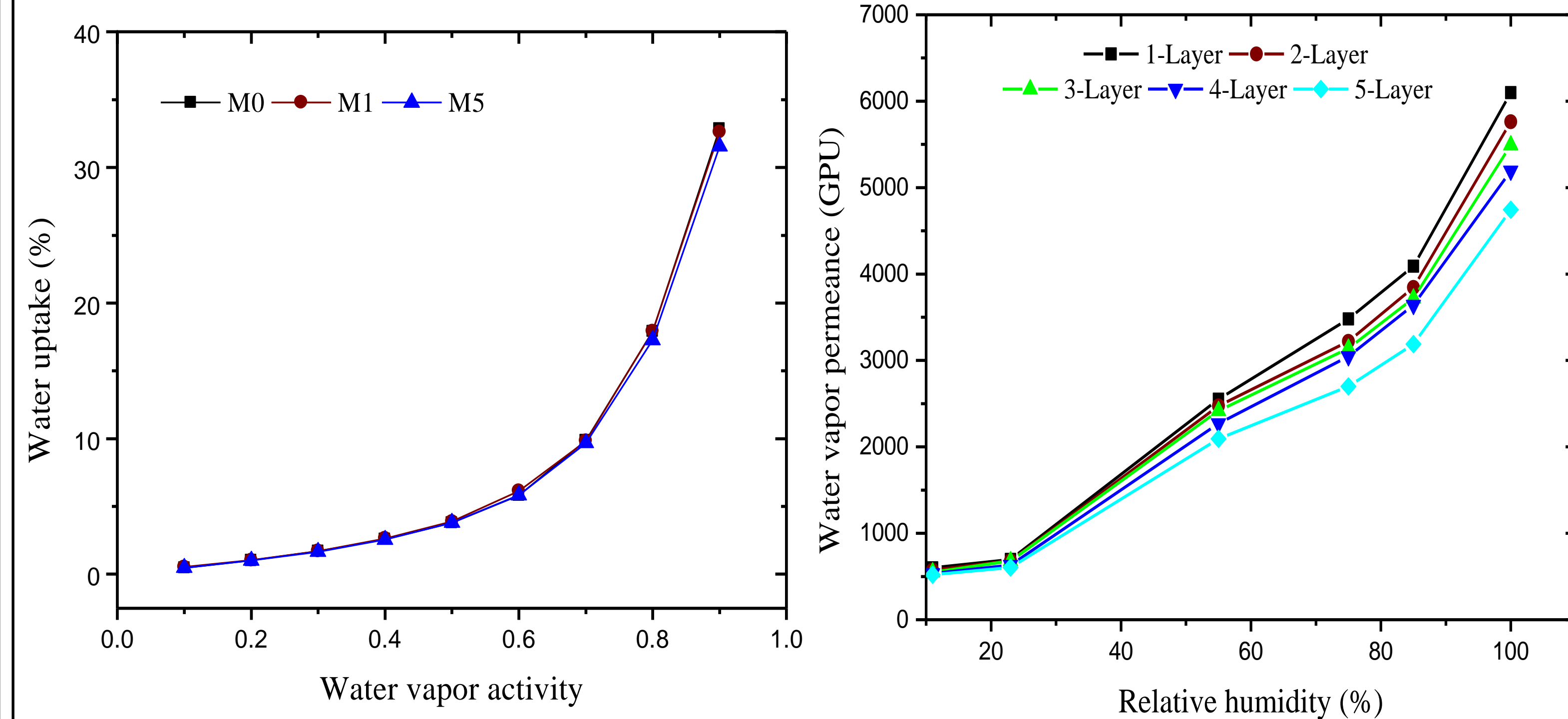
Reduction in OH group intensity & disappearance of C=O groups after thermal reduction of GO

An increase in peak intensity with increase in GO nanosheets

Results



A 10% decrease in water vapor flux with a 50% increase in H₂O/N₂ selectivity showing improved performance.



An increase in water uptake with increase in relative humidity but no major difference with the increase in GO nanosheets

Effect of humidity on water vapor permeance with different coating layers

References:

Akhtar, F.H., Journal of Membrane Science (2016), doi:10.1016/j.memsci.2016.

