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Studies on the structure - diffusion relationship for hybrid polymer membranes

Thursday, September 6, 2018 3:00 PM (3 hours)

Hybrid alginate membranes filled with various amount of magnetite (Alg/Fe_3O_4) and crosslinked using four different agents, i.e. calcium chloride ($AlgCa$), phosphoric acid ($AlgP$), glutaraldehyde ($AlgGA$) and citric acid ($AlgC$) were applied in pervaporative dehydration of ethanol and were described in paper [1].

In this work, the membranes are characterized by the parameters like: the amount of polymer matrix, the fractal dimension of polymer matrix, the average size of polymer matrix domains, the average number of obstacles in the proximity of each polymer matrix pixel. Determination of the above mentioned characteristics base on the image analysis of a sufficiently large cross - sections of the membranes.

Diffusive transport is investigated by simulation of a particle motion in the membrane environment. Diffusion driven by Gaussian random walk and Lévy flights is shown in order to check if the effective diffusion exponent at long time limit is subdiffusive and if it depends on the details of the underlying random process causing diffusion.

Thanks to such research the relationship between chemical composition, structure and morphology, and separation properties of the membranes can be determined.

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[2] M. Krasowska, A. Strzelewicz, G. Dudek, M. Cieřła, Structure-diffusion relationship of polymer membranes with different texture, Physical Review E 95, 012155 (2017)

[3] A. Strzelewicz M. Krasowska, G. Dudek, A. Rybak, R. Turczyn, M. Cieřła, Anomalous diffusion on fractal structure of magnetic membranes, ActaPhysicaPolonica B, 44 (2013) 955-965

[4] M. Krasowska, A. Strzelewicz , A. Rybak, G. Dudek, M. Cieřła, Structure and transport properties of ethylcellulose membranes with different types and granulation of magnetic powder, Physica A: Statistical Mechanics and its Applications, 452 (2016) 241–250

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