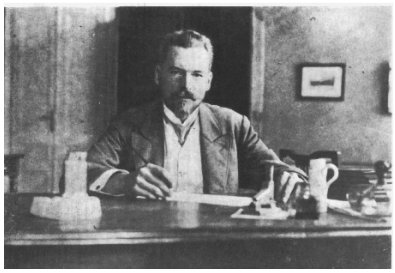

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Stereological-fractal analysis as a tool for a precise description of the morphology of hybrid alginate membranes

Monday, 3 September 2018 17:35 (20 minutes)

A precise description of the morphology of a material is necessary in order to establish structural and functional relationships [1]. Tools (methods) for morphological analysis should be quantitative techniques, which would yield objective and reproducible values for any morphological structure and enable statistically defined comparisons. The combination of the stereological analysis and fractal analysis provides the researchers with such a tool. This work investigated hybrid alginate membranes filled with various amount of magnetite (Fe_3O_4) and crosslinked using four different agents, i.e. calcium chloride ($AlgCa$), phosphoric acid ($AlgP$), glutaraldehyde ($AlgGA$) and citric acid ($AlgC$). Alginate membranes can be used to dehydrate ethanol in the process of pervaporation [2–3]. The morphology of the studied membranes was characterized on the basis of the image analysis of the membrane's cross-section obtained from a scanning electron microscope Phenom Pro-X. The quantitative analysis of the structure and morphology of the above-named materials included the stereological analysis and the fractal analysis. The stereological analysis was based on shape descriptors (elongation factor f_1, surface factor f_2, irregularity parameter f_3) and bulkiness f [2, 4]. Generalized fractal dimension [5] and lacunarity [6] constitute the basis of fractal analysis. In relation to the membranes subjected to the tests, it was possible to identify the correlation between transport properties (pervaporation separation index (PSI)) and morphological parameters. The use of a comprehensive analysis made it possible to determine the morphology of the membrane with the best separation properties. The membranes of the highest self-similarity were also characterized by the highest separation properties.

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