Contribution ID: **1070** Type: **Poster Presentation**

PTFE-based pore-filled ion exchange membranes for electrodialysis and energy conversion processes

Tuesday, 23 May 2023 10:30 (1h 30m)

Ion-exchange membranes(IEMs) have been widely used for desalinated and energy conversion processes. Since the IEMs determine the efficiency of the above process, it is necessary to develop them with impoved separation performance and durability. Novel composite-type anion- or cation- exchange membranes were prepared as follows; first, pore-filling of monomer mixtures (styrene/ divinylbenzene (DVB), vinylbenzylchloride(VBC/DVB)) and an initiator was done in commercial polytetrafluoroethylene(PTFE) porous films, respectively. Thermal polymerization was followed in high temperature oven for the formation of precursor membranes. Post-sulfonation was done with chlorosulfonic acid in methylene chloride to give -SO3H for the preparation of cation exchange membranes. Post-amination was performed in trimethylamine (TMA) in acetone to give -N+(CH3)3- for the preparation of anion exchange membranes. SEM analysis confirmed these membranes were successfully prepared.
The electrochemical properties of the resulting membranes - ion exchange capacity, electric resistance and water content - were studied in terms of the ratio of dope compositions of monomers (Styrene/DVB, VBC/DVB).The composite membranes showed excellent electrochemical properties –electric resistance, water content and IEC value - depending on the monomer dope compositions (Styrene/DVB ratio and VBC/DVB ratio). These membranes showed lower electric resistances, lower water contents and higher IECs than commercial membranes thanks to thin PTFE supports. These results showed our composite membranes could be applied to the desalinatings electro-dialysis and energy conversion process.

Participation

In-Person

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Session Classification: Poster

Track Classification: (MS22) Manufactured Porous Materials for Industrial Applications