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## The development and the application of porous membrane via surface modification for all-vanadium redox flow batteries

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**Statement of the Problem:** The porous membranes are well known with their cost advantage. However, they suffer from the cross-over of redox active species despite their cost advantages. The aim of this study was to develop the permeability decrease of Amer-Sil FF60 porous membrane via surface modification through spraying.

**Methodology:** FAP<sup>®</sup> 450 (FuMA-Tech, Germany), Nafion<sup>®</sup> 117 (DuPont, the USA) and Amer-Sil FF60 porous membrane (Amer-Sil, Luxembourg) were employed in this study. Porous membrane's one face was modified with two different proportions of Nafion<sup>®</sup> (5, 7%, wt) dispersion such as (0.5:1) and (1:1). Spraying technique was utilized as modification method. The membranes were characterized in terms of vanadium ion permeability, ionic conductivity, water uptake, cell tests. Besides, the Nafion<sup>®</sup> dispersion stability on the membrane surface after cell tests was utilized.

**Findings:** The diffusion of V<sup>4+</sup> ions could be declined with upon the addition of Nafion<sup>®</sup> (5.7%, wt). With the addition of Nafion<sup>®</sup> (5.7%, wt) dispersion, both proton conductivity and swelling degrees were decreased owing to the hydrophobic group of polytetrafluoroethylene (PTFE). It was observed that the coulombic, energy efficiencies and discharge power densities of modified porous membranes were improved better compared to the unmodified ones.

**Conclusion & Significance:** It was denoted that the modified porous membrane's performances could be accomplished circa 10-15% compared to the unmodified porous membrane. It might be claimed that the modification of Amer-Sil FF60 may be considerable when the feasibility of all membranes were evaluated. According to the Nafion<sup>®</sup> (5.7%, wt) stability test, it was reported that the Nafion<sup>®</sup> (5.7%, wt) dispersion could not be stayed on the surface of the membrane as it was interacted via highly acidic vanadium electrolyte medium.

### Biography

Dilek Yalcin has two science graduates one in Chemistry and the other in Chemical Engineering, respectively from Ankara University, Ankara and Osmangazi University, Eskisehir. She is pursuing her Master's education in Electrochemical Energy Storage Technology with Prof. Dr. Yucel Sahin whose one of research interests is also on vanadium redox flow batteries at Yildiz Technical University, Istanbul. She has chosen the membrane material research for all-vanadium redox flow batteries and completed her experimental work under the supervision of Dr.- Ing. Burak Caglar whose one of expertises is on redox flow batteries at Fraunhofer, ICT, Institute For Chemical Technology, Germany. After having her Master of Science degree, she likes to study on membrane material research and development for electrochemical energy storage technology for her PhD.

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