Área: MAT_____
(Inserir a sigla da seção científica para qual o resumo será submetido. Ex: ORG, BEA, CAT)

Polyethene-Derived Anion-Exchange Membranes Synthesized Through Gamma-Simultaneous-Radiation-Induced Grafting For H_2 Fuel Cells

Marco A.O.S. Minadeo (MAOSM) (PQ),[1] Heloísa A. Zen (HAZ) (PQ),[1] Andrey S. Barbosa (ASB) (PQ),[1] Janayna C.V. Landucci (JCVL) (PG),[1] Elisabete I. Santiago (EIS) (PQ).[1]*

marco.m@ipen.br; eisantia@ipen.br

[1]*Center of Fuel Cells and Hydrogen, Nuclear and Energy Research Institute (IPEN/CNEN)*

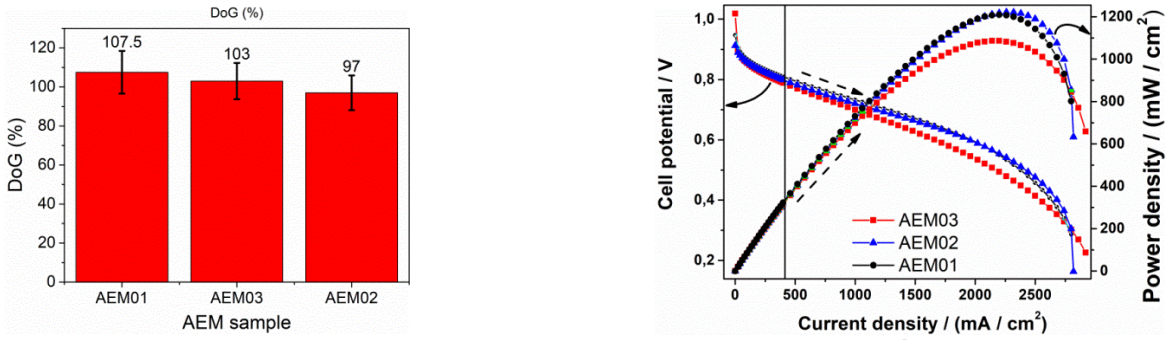
Keywords: *radiation-induced grafting, anion-exchange membrane fuel cells, low-density polyethene, cross-linked polymers, simultaneous grafting.*

Highlights

Gamma-radiation-induced grafting produces anion-exchange membranes based on low-density polyethene for high performance anion exchange membrane fuel cell application.

Resumo/Abstract

Anion-exchange membrane fuel cells (AEMFCs) are devices based on the electrochemical conversion of chemical energy into electrical one by using hydrogen fuel. As characteristics of AEMFCs are: using of polymeric solid-state as electrolyte and separator (AEMs) low temperature operation, mild conditions $H_{2(g)}$no emissions of pollutants if H_2 is produced from non-carbonaceous source. In this work, anion-exchange membranes (AEMs) were synthesized using commercial low-density polyethene (LDPE) films as base polymer, being its modification to a functional AEM achieved by applying the simultaneous radiation-induced grafting technique (RIG). In RIG technique the polymer films are γ- rays irradiated in a precursor grafting solution, thus promoting the simultaneous grafting of this molecule as well as crosslinking of the polymer, which can act as a mechanical reinforcement. The crosslinking was conducted simultaneously with the grafting or in separate steps of irradiation. As a sequence, LDPE-VBC-grafted membranes were aminated with trimethylamine to obtain the trimethylammonium resulting AEMs. The samples were named in accordance with the radiation dose (*x*+*y*) kGy means the pristine LDPE film was irradiated with *x* kGy in $N_{2(g)}$, and then with *y* kGy in the grafting solution in a subsequent step. Samples: AEM01: 16 kGy, AEM02: (16+16) kGy, AEM03: (12+16) kGy. Figure 1a shows a linear decrease in the degrees-of-grafting (DoGs) of LDPE films as the first radiation dose, applied in $N_{2(g)}$, increases, due to the smaller absorption of the grafting solution by the more branched films. Figure 1b shows the polarization curves for single fuel cells, in which high values of maximum power density of *ca.* 1.25 W/cm^2 at a current density of *ca.* 2.25 A/cm^2 were obtained.



a **b**

Figure 1. **a)**: DoGs for AEMs produced with different radiation doses (see previous text). **b):** polarization curves for AEMFCs fabricated with these AEMs. Anode: pure $H_{2(g)}$. Cathode: pure $O_{2(g)}$.

References

1. *Energy & Environmental Science* (2019) 12, 1575.
2. *Journal of Membrane Science* (2022) 659, 120804.

Agradecimentos/Acknowledgments

To the project SisH_2 from CNPq (n. 407967/2022-2) and the scholarship received (n. 380324/2024-5).