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New modified Nafion-bisphosphonic acid composite membranes for enhanced proton conductivity and PEMFC performance

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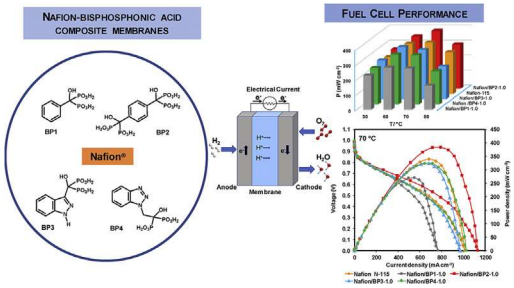
HIGHLIGHTS

- Nafion membranes doped with aryl and azaheteroaromatic bisphosphonates were prepared.
- Doped membranes showed higher water uptake and ionic exchange capacity than Nafion.
- New membranes had higher proton conductivity than Nafion at the same conditions.
- Fuel cell performance was evaluated from 30 °C to 120 °C.
- Nafion/BP2-1.0 showed higher power density than Nafion at all studied temperatures.

GRAPHICAL ABSTRACT



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ABSTRACT

Proton exchange membranes remain a crucial material and a key challenge to fuel cell science and technology. In this work, new Nafion membranes are prepared by a casting method using aryl- or azaheteroaromatic bisphosphonate compounds as dopants. The incorporation of the dopant, considered at 1 wt% loading after previous selection, produces enhanced proton conductivity properties in the new membranes, at different temperature and relative humidity conditions, in comparison with values obtained with commercial Nafion. Water uptake and ionic exchange capacity (IEC) are also assessed due to their associated impact on transport properties, resulting in superior values than Nafion when tested in the same experimental conditions. These improvements by doped membranes prompted the evaluation of their potential application in fuel cells, at different

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