

Finite element simulations of the bending of the IPMC sheet

D. Pugal, H. Kasemägi, M. Kruusmaa, A. Aabloo, K. J. Kim

Institute of Technology, Tartu University, Nooruse 1, 50411 Tartu, Estonia
University of Nevada, Reno

ABSTRACT

Finite Element method is used to build and simulate an IPMC sheet. The physical bending of the realistic Nafion sheet due to the drift of counter-ions (e.g Na⁺) and dragged water in applied electric field are simulated. The other effects like viscous resistance and diffusion of water, also the porous nature of the environment inside the Nafion are taken into account. The effect of the concentration of water and counter-ions near the electrodes are tried to relate to the physical bending of the IPMC sheet. Some additional effects like voltage drop at more distance points from contacts instead of constant electric field and electrolysis for more complex model are discussed.

Keywords: Electroactive polymers, EAP, Finite element method, Electrochemical-mechanical analysis, Actuator, Coupled problem

1. INTRODUCTION

EAP-based electromechanical actuators are valuable for use in a number of applications starting with miniature robotics upto military and space. These actuators have light weighth, noiseless motion, simple mechanical constrution; large controlled displacement and good damage tolerance along with an ability to perform different movements like bending and contractions makes possible to use them as artificial muscles.

2. SIMULATION DETAILS

3. RESULTS AND DISCUSSION

4. CONCLUSIONS

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Further author information: (Send correspondence to Alvo Aabloo)
Alvo Aabloo: Email: alvo.aabloo@ut.ee

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