Reversed electro-dialysis energy harvesting from polyelectrolytes and hydrogels functionalized conical nanopores

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Water is used as an energy resource since hundreds years. Besides of hydroelectric process, the difference of salinity is also the source of power using two methods: pressure-retarded osmosis and reversed electro-dialysis which were close to commercialization nowadays[1]. However they suffer from low yield. For reversed electro-dialysis, the membrane permselectivity is a crucial limiting factor[2]. To improve that, we design two kinds of ion selective membranes based on PET conical membranes functionalized by polyelectrolytes and hydrogels. For anion-selective membranes, polyethylenimine and a hydrogel[3] containing (3-acrylamidopropyl)trimethylammonium chloride, acrylamide, bis were considered. For cation-selective membranes, poly-l-lysine/ polyacrylic acid and hydrogel containing 3-sulfopropyl acrylate (potassium salt), 2-hydroxy-4 ′ -(2-hydroxyethoxy)-2- methylpropiophenone, acrylamide, bis were considered. First, we have studied the ionic transport and the selectivity on single nanopore. Rectification factor and osmotic current were recorded by current-voltage measurements. Second, the single nanopores were scaled-up to low-density multipore membranes and the power measurements were performed. Finally a stacked multi-pair membrane systems were tested to evaluate the real power density as its commercial form.

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