Development of composite membranes is a suitable alternative to improve the hydrogen flux through palladium membranes. The used substrate should provide high mechanical strength and low mass transfer resistance in order to obtain high hydrogen fluxes. Here we propose the application of asymmetric alumina hollow fibres as the substrate for Pd deposition. Asymmetric alumina hollow fibres were produced by the phase inversion technique. A mixture of dimethyl sulfoxide (suspension solvent) and ethanol was used as bore fluid. Pure water was used as external coagulant and the fibre precursors were immersed in the coagulation bath with no air gap. Flows of ceramic suspension and bore fluid were controlled and monitored at 15 mL min^{-1} using two individual pumps. The fibre precursor was sintered at 1350°C. The support characterisation showed that it presented suitable mechanical strength (55.30 ± 2.81 MPa) and the desired asymmetric structure with an outer denser layer and inner micro- voids. Water permeability through the produced hollow fibres was of 38.907 L h^{-1} m^{-2} kPa^{-1}. Average rugosity of the hollow fibre outer surface was of 111.6 nm. Three layers of Pd were deposited on the support by using the electroless plating technique which resulted in a thickness of 3.493 ± 0.093 µm for Pd membrane. The hydrogen permeability was evaluated through the composite membrane at several pressures and temperatures, as presented in Figure 1. None nitrogen leak was detected through the membrane which means the membrane is completely selective to hydrogen.

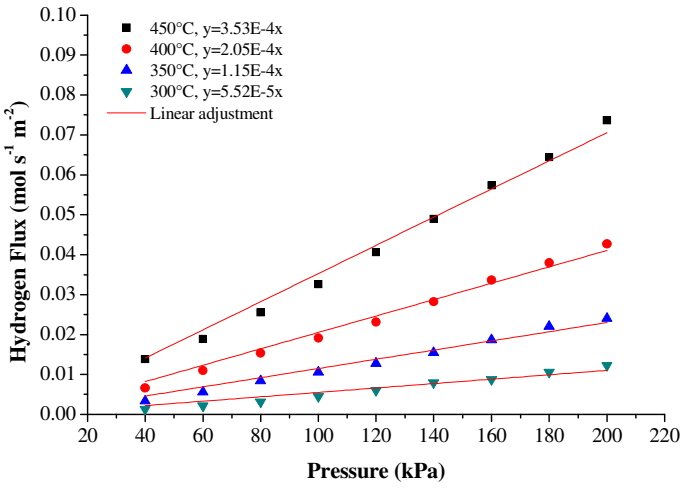


Figure 1. Hydrogen flux through the composite membrane.

As presented in Figure 1, experimental data of hydrogen fluxes were quite well linearly adjusted ($R^2 \geq 0.99$) to pressure considering all temperatures for all the evaluated membranes, which indicates that not only the bulk diffusion through the Pd layer was the rate controlling step. Hydrogen fluxes increased with the increase in pressure and temperature. However, the literature presents even greater hydrogen fluxes through composite membranes. A smoothing of the substrate surface is suggested to decrease the Pd thickness and, consequently, to increase hydrogen fluxes.