(S1)

(S2)

(S3)

with L: membrane thickness, : oxygen flux through the membrane, Co: molar oxygen concentration in the membrane close to the oxygen lean surface***,*** : gradient of oxygen chemical potential through the membrane bulk (FIG. 5a), : gradient of oxygen chemical potential between the gas at the vicinity of the oxygen rich surface and the membrane bulk close to the oxygen rich surface (FIG. 5a), : gradient of oxygen chemical potential between the gas at the vicinity of the oxygen lean surface and the membrane bulk close to the oxygen lean surface (FIG. 5a), n: exponent coefficient, constant between 0 and 1 (n = 0.5 for mixed conductors).