$D\_{o}=\frac{4RTLJ\_{O\_{2}}}{C\_{O}∆μ\_{O\_{2}}^{bulk}}$ (S1)

$k\_{i}={2J\_{O\_{2}}}/{\left(C\_{O}\left(exp\left(\frac{\left(1-n\right)∆μ\_{O\_{2}}^{i}}{RT}\right)-exp\left(\frac{-n∆μ\_{O\_{2}}^{i}}{RT}\right)\right)\right)}$ (S2)

$k\_{d}={2J\_{O\_{2}}}/{\left(C\_{O}\left(exp\left(\frac{(1-n)∆μ\_{O\_{2}}^{d}}{RT}\right)-exp\left(\frac{-n∆μ\_{O\_{2}}^{d}}{RT}\right)\right)\right)}$ (S3)

with L: membrane thickness, $J\_{O\_{2}}$: oxygen flux through the membrane, Co: molar oxygen concentration in the membrane close to the oxygen lean surface***,*** $∆μ\_{O\_{2}}^{bulk}$: gradient of oxygen chemical potential through the membrane bulk (FIG. 5a), $∆μ\_{O\_{2}}^{i}$: 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), $∆μ\_{O\_{2}}^{d}$: 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).