The understanding of retention and re-emission of hydrogen in graphites, carbon based materials and co-deposited layers is important for fusion plasma density control and for the determination of tritium inventory in future fusion machines. The hydrocarbon deposits found on the leading edge of the neutraliser of Tore-Supra consists of micropores with typical size lower than 2 nm (≈ 11%), mesopores (≈ 5%) and macropores with a typical size more than 50 nm [1]. The mesopores and micropores are slit shaped. We use kinetic Monte-Carlo to study the reactive-diffusive transport of hydrogen in a 3D, porous geometry typical of the Tore-Supra co-deposited layers. Sensitivity studies on the effect of the internal structure i.e. void fraction, void size and void orientation has been done. An extension of this model is presented, including chemical erosion process based on the Küppers-Hopf cycle [2].