In this work, the simulation of ions density distribution evolution within the oxide of MOS structures is performed. This simulation is achieved by solving the partial differential equation (PDE), which governs the motion of the ions in the oxide layer, subject to boundary and initial conditions. Since no closed form analytical solution is available in the literature to solve this important problem, a numerical technique based on Crank-Nicholson method is used. The evolution of ions density distribution is simulated for different values of such parameters as applied electric field and device temperature using BTS technique. The simulation results agree well with the experimental results as well as the previous published results