In a next-step magnetically confined fusion devices, such as ITER, it is very important to estimate lifetime of plasma-facing components in which are made with carbon-based materials. And to reveal a process of chemical erosion of the facing components via formation of hydrocarbon molecules is a crucial issue. In many recent tokamaks, chemical sputtering yields are experimentally measured by spectroscopic method using inverse photon-efficiency D/XB. Photon fluxes are converted into particle fluxes with aid of effective D/XB values, and effective D/XB values are critical factors in the study of chemical erosion by spectroscopic measurements.

In this study, effective D/XB values of hydrocarbon molecules (CD$_4$, C$_2$D$_x$($x = 2, 4, 6$), C$_3$D$_y$($y = 4, 6, 8$)) for CD and C$_2$ emissions have been calculated by a Monte Carlo simulation. In a simple modeled divertor plasma region with the constant temperature and density, hydrocarbon transport are simulated [1]. The CD Gerō band and C$_2$ Swan band emission intensities are calculated in a condition of corona equilibrium. The complex dissociation and ionization reactions of hydrocarbon molecules and the surface reflection process are taken into account. The simulation volume is $10 \times 10 \times 10$ cm$^{-3}$. The angle of the magnetic field lines with the toroidal direction is $5^\circ$ and the lines are inclined by $30^\circ$ against the poloidal direction. The magnetic filed strength is 5 T. The hydrocarbon molecules are released at the center of the divertor plate with a Maxwellian velocity distribution corresponding to a temperature of 0.1 eV (1160 K). The released particle number is $10^5$.

In the condition of the multiple reflection at the divertor surface and the plasma density of $1.0 \times 10^{19}$ m$^{-3}$, the calculation of the temperature dependence of effective D/XB values, for CD and C$_2$ from methane (CD$_4$), ethane family (C$_2$D$_2$, C$_2$D$_4$, C$_2$D$_6$) and propane family (C$_3$D$_4$, C$_3$D$_6$, C$_3$D$_8$), has been performed. The D/XB values decrease with increasing the temperature up to 5 eV and then increase with the temperature caused by decrease of number of hydrocarbon fragments, which are produced by dissociation processes, of type CD and C$_2$. In the comparison with experimentally determined values [2], a good agreement is obtained for CD emission in the region in which the plasma temperature is higher than 25 eV. On the other hand, for C$_2$ emission, there are qualitative agreements. But experimental values are several times larger than those of the calculated.