doi:10.1351/goldbook.RT07474

rotational correlation time, τ_c or θ

Parameter describing the time dependence of the tumbling of a molecular entity in a medium of viscosity η. The rotational correlation time can be obtained from the decay of the fluorescence or phosphorescence anisotropy and is related to the average molecular rotational diffusion coefficient, D_r, in turn related to the hydrodynamic molecular volume of the fluorophore, V, and to η (see Note 3).

Notes:

1. Mathematical definition: $r(t) = r_0 \exp(-\frac{t}{\tau_c})$ with $r(t)$ the emission anisotropy at time t and r_0 the fundamental emission anisotropy.
2. In the case of a spherical emitting species reorienting itself in a homogeneous fluid, $\tau_c = \frac{1}{6 D_r}$.
3. Often, the Stokes–Einstein relationship is used for the calculation of D_r, i.e., $D_r = R\,T / 6\,V\,\eta$ with R the gas constant, T the absolute temperature and V the hydrodynamic molecular volume. However, the use of this relationship at a molecular level is questionable, and D_r should be independently determined by time-resolved fluorescence polarization methods. Compare with rotational relaxation time.

Source:

PAC, 2007, *79*, 293 *(Glossary of terms used in photochemistry, 3rd edition (IUPAC Recommendations 2006))* on page 416

