Electron paramagnetic resonance (EPR) zero-field splittings $D$ for Mn$^{2+}$ and Fe$^{3+}$ in wurtzite GaN crystals are studied from high-order perturbation formulas based on the spin-orbit mechanism in both weak- and strong-field schemes. From these studies it can be seen that the Mn$^{2+}$ or Fe$^{3+}$ impurity does not occupy the exact Ga$^{3+}$ position, but is displaced by $\Delta R$ on the $C_3$ axis. The displacements are confirmed from a study of the superposition model, based on which a normal value of $\bar{b}_2(R_0)$ ($\approx -0.34 (15) \text{ cm}^{-1}$) for the Fe$^{3+}$-N$^{3-}$ combination is suggested. The EPR parameters $D$, $g||$ and $g\perp$ for Ni$^{3+}$ in GaN crystals are also studied. It is found that Ni$^{3+}$ is almost not displaced. The impurity displacements in GaN are discussed by considering the valences and radii of these impurity ions and the replaced Ga$^{3+}$ ion. – Pacs: 61.16Hn; 76.30Fc; 71.70Ch

Key words: Defect Structure; EPR; Crystal Field Theory; GaN; Fe$^{3+}$; Mn$^{2+}$; Ni$^{3+}$. 