Paramagnetism

Most materials whose atoms or molecules have permanent dipole moments are **paramagnetic**. In these materials, the interaction between dipoles is insignificant; in the absence of an external magnetic field, the dipoles are randomly oriented and the total dipole moment is zero. When an external magnetic field is applied, the magnetic torque on each dipole tends to make it line up with the field. However, the random thermal motion of the dipoles keeps the average degree of alignment very small. Two consequences of this weak alignment are that the magnetic field inside the material is slightly larger than the external field, and the material is weakly attracted toward a region of stronger external field. The **magnetization**—the net dipole moment per unit volume—for a given applied field is larger at lower temperatures; less thermal energy allows a greater degree of alignment of the dipoles.