Material Responses in Electrostatics and Magnetostatics

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	Dielectric Ferroelectric	Parallel-electric	Diamagnetic	Paramagnetic Ferromagnetic	Conductor
Direction of material response field compared to inducing field	opposite	parallel	opposite	parallel	perfectly opposite
Material's effect on internally applied **E** or **B** field	**E** weakened	**E** strengthened	**B** weakened	**B** strengthened	**E** = 0, **B** = 0
Characterization	$\varepsilon > \varepsilon_0$	$\varepsilon < \varepsilon_0$	$\mu < \mu_0$	$\mu > \mu_0$	$\sigma \to \infty$
Material component interacting	polarized bound charge regions	polarized bound charge regions	magnetized bound currents	magnetized bound currents	free charges and currents
Effect on external fields lines near surface	partially sucks in **E** field lines	partially pushes out **E** field lines	partially pushes out **B** field lines	partially sucks in **B** field lines	**E** is normal **B** is tangential
Force on external charges or magnets	attracts charges	repels charges	repels magnets	attracts magnets	attracts charges, repels magnets
Example materials	glass plastic water diamond	none in electrostatics	diamond graphite bismuth copper	iron steel cobalt nickel	silver copper gold aluminum

Note: Ferroelectricity and Ferromagnetism are nonlinear, history-dependent effects, in contrast to all the other responses. However, for the purposes of general conceptualization, they can be classed with dielectricity and paramagnetism respectively.

Parallel-electric materials (distinct from paraelectrics) do not exist in electrostatics. In electrodynamics, however, the permittivity *can* become negative. This is because the charges get out of phase from the driving fields, but this is a time-dependent effect.

Most materials simultaneously exhibit electric, magnetic, and conductive effects, even if only in small amounts.