Answer on Question #73802, Physics / Electric Circuits

State and explain the boundary condition for the displacement vector D at the boundary separating two dielectric media.

Answer:

By definition, displacement vector:

$$\vec{D} = \varepsilon_0 \vec{E} + \vec{P} = \varepsilon \varepsilon_0 \vec{E}$$

Where:

$\vec{E} - electric\ field, \vec{P} - polarization\ vector, \varepsilon_0 - vacuum\ permitivity, \varepsilon - relative\ permitivity$

Boundary conditions for a displacement vector:

$(\vec{D_1} - \vec{D_2})\vec{n} = \sigma_{surf}$

Here, $\sigma_{surf} - free\ charge\ density\ on\ the\ surface,$

$n - normal\ vector\ in\ the\ direction\ from\ medium\ 1\ to\ medium\ 2$

Physically, this means that on the boundary of two surfaces free charges appear. Their surface density is determined by the difference of displacement vectors normal projection.
If two surfaces has equal normal projections of displacement vector, no free charges appear on the boundary