Displacement current i_d :

From Gauss's law, we know that,

$$\int \vec{E} \cdot \hat{n}\, ds = \frac{Q}{\epsilon_0}.$$

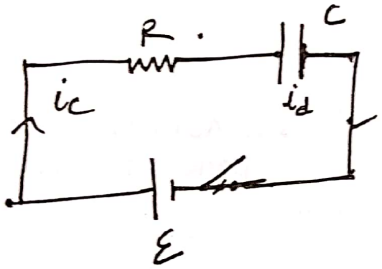
or. $Q = \epsilon_0 . \Phi_E$.

or. $\frac{dQ}{dt} = \epsilon_0 \frac{\partial \Phi_E}{dt} = i_d$.

or. $i_d = \frac{\partial \Phi_D}{\partial t}$ = displacement current.

or. $\vec{J_D} = \frac{i_D}{A} = \frac{\partial (\vec{D} \cdot \vec{A})}{\partial t \cdot (A)} = \frac{\partial \vec{D}}{\partial t}$ = displacement current density

∴ Displacement current arises due to time varying electric flux or time varying displacement flux.



During charging of a capacitor, outside the capacitor Conduction current flows and inside the capacitor displacement current flows.