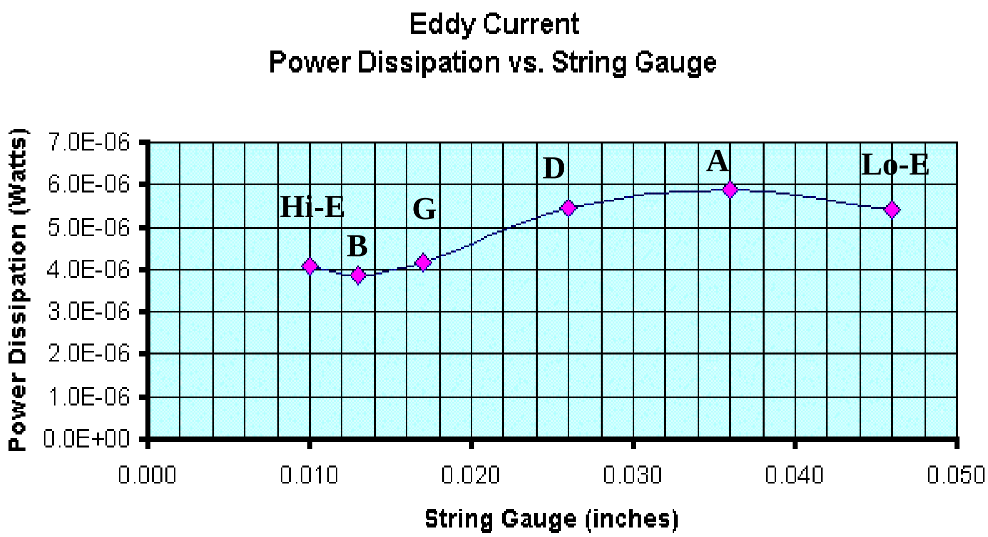
It can be seen from the above figure that the magnitude of the induced EMF, $|\varepsilon|$ is linear with frequency, f; thus the magnitude of the induced EMF, $|\varepsilon|$ has a quadratic dependence on string gauge/string diameter.

Because the metal of the vibrating string has a finite (but very small) electrical resistance, R_{string} associated with it, the electrical energy associated with the induced Eddy current(s) flowing in the string is dissipated - ultimately, it is converted into heat energy. The instantaneous power loss, $P_{Eddy}(t)$ due to the induced Eddy current(s) flowing in the string is given by:
The (peak) power dissipation, or power loss due to Eddy currents in each of the strings of the

$$P_{Eddy}(t) = \frac{dE_{Eddy}(t)}{dt} = \varepsilon(t) * I^*_{Eddy}(t) = \frac{|\varepsilon(t)|^2}{R_{string}}$$

guitar is shown in the figure below, for the same values of parameters as used in creating the above two figures.



Note that the (peak) power dissipation is approximately constant with string gauge/fundamental frequency, $P_{Eddy} \sim$ 4-6 μW, and depends quadratically on B(z = h), since both I_{Eddy} and $|\varepsilon|$. Note also that the time-averaged, or root-mean-square (rms) power dissipation, $\langle P_{Eddy} \rangle$ is half of the peak power dissipation value.

The vibrational energy of the guitar strings is slowly dissipated via magnetically-induced Eddy current power losses in each of the strings. The vibrations of the guitar string are thus *magnetically damped*. The amplitude of the string vibrations slowly decays (exponentially) with time due to magnetic damping of the strings by the strings vibrating in the magnetic field(s) of the guitar pickups, with a characteristic time constant, τ_{Eddy} which is given by:

$$\tau_{Eddy} = \frac{2\mu}{b}\left[1 + \left(\tfrac{b}{2\mu\omega}\right)^2\right]^{1/2} \qquad where \qquad b = \pi r^2_{string} \sigma B^2(z=h)\sin^2\varphi$$