



Microwave Field Effects

The challenge is to understand the underlying physics behind the phenomena of edge-underheating in thin food slices after microwave heating (0.9 or 2.45 GHz). In this case “thin” means a slice thickness much less than the wavelength of the microwave radiation, typically 1.5 to 3.0 mm in practical applications.

Edge-underheating is observed strongly in mono-mode applicators, where the slice edges tangential to the field vector are fully heated but the slice edges normal to the field vector are strongly underheated. In multi-mode applicators (e.g. domestic microwave oven and industrial cavities), the whole perimeter of the food slice is under-heated. The pictures below show the effect, and the hypothesis of resultant field strengths which lead to observed edge-underheating.

Mono-mode applicators with single field pattern can generate significant edge under-heating due to field vector effect



Single mode 915MHz
(15 cm wide belt)
(field orientation shown)

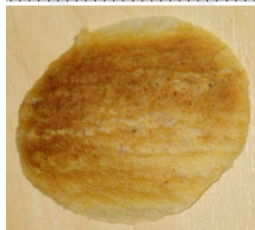
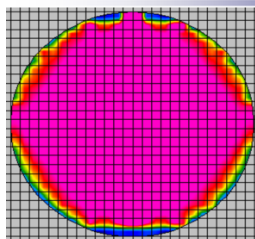


Field Vector Effect
Left-Right edges were not heated at all, even when centre of chip was scorched



Field Strength Effect
Very close slices in very high field intensity lead to arcing

Computer simulations confirm edge-underheating principle



Electric Field vector
Direction of travel

Hypothesised field strength in food slice to explain edge-underheating
(E_0 is the free space microwave field strength)

