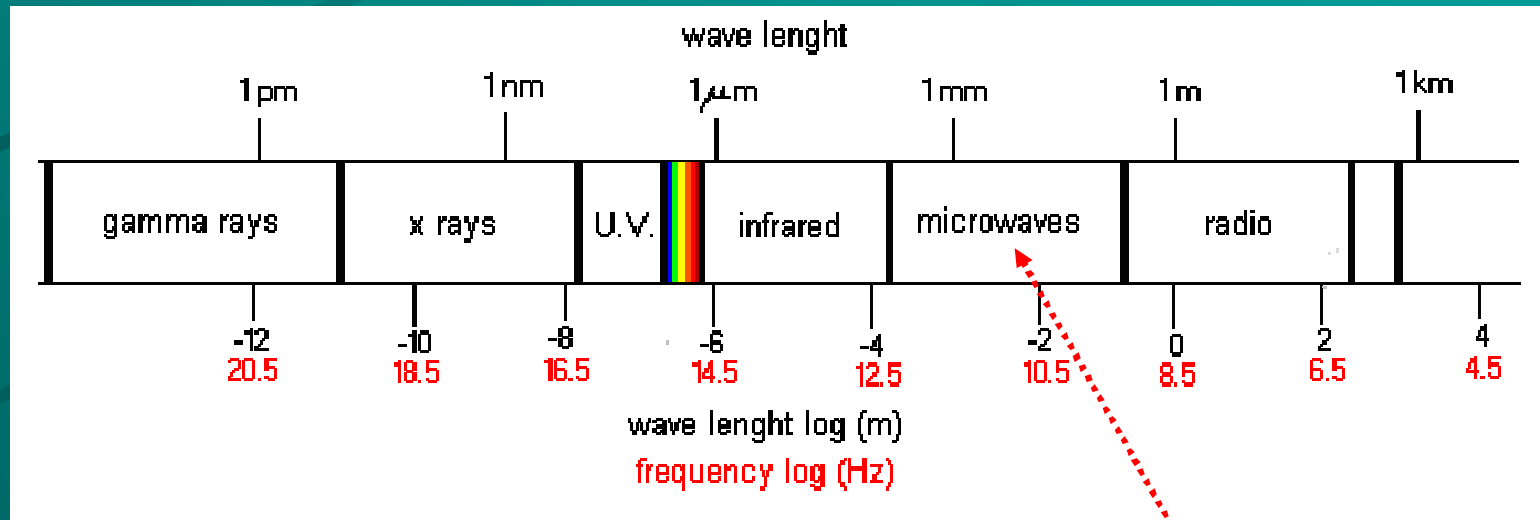


Microwaves technology



- *Microwaves are electromagnetic radiations having frequencies between 0.3 e 300 GHz and waves lenght between 1 mm e 1 m*



Interactions between materials and microwaves

Materials having different electrical features react in different ways if exposed to electromagnetic field.

Generally speaking, we can share them in three categories:

Transparent

Polymers

Wood

Glass (T < 50°C)

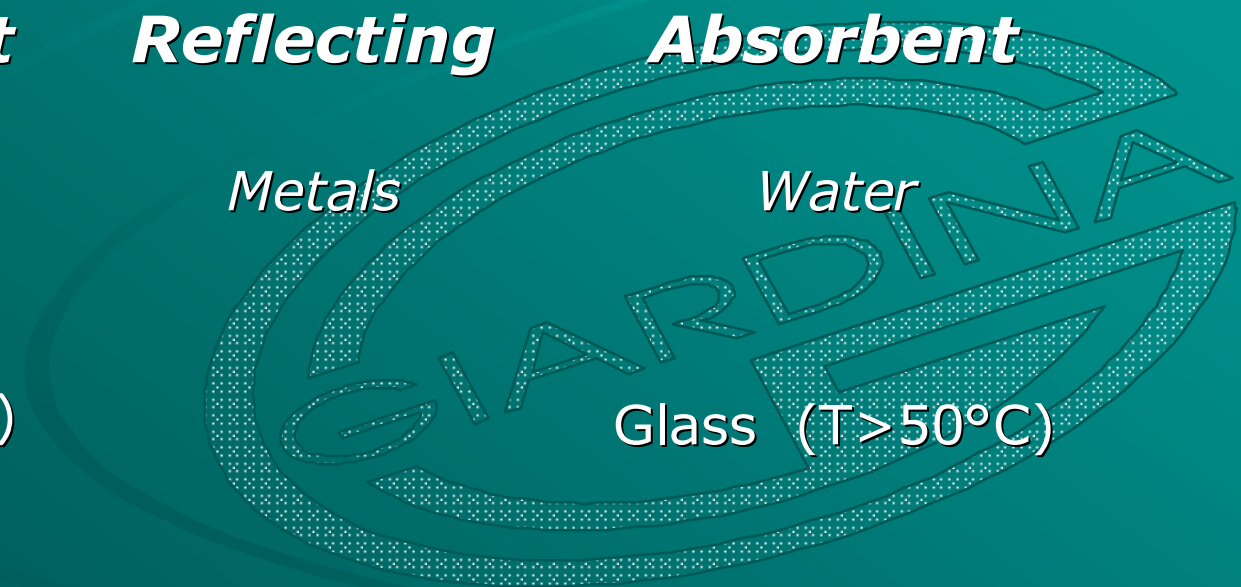
Reflecting

Metals

Absorbent

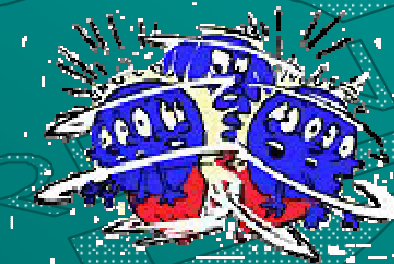
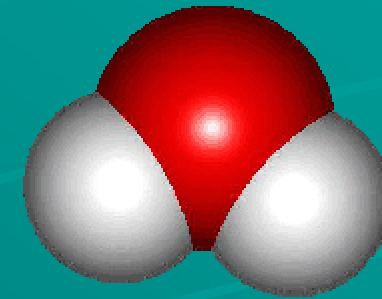
Water

Glass (T > 50°C)

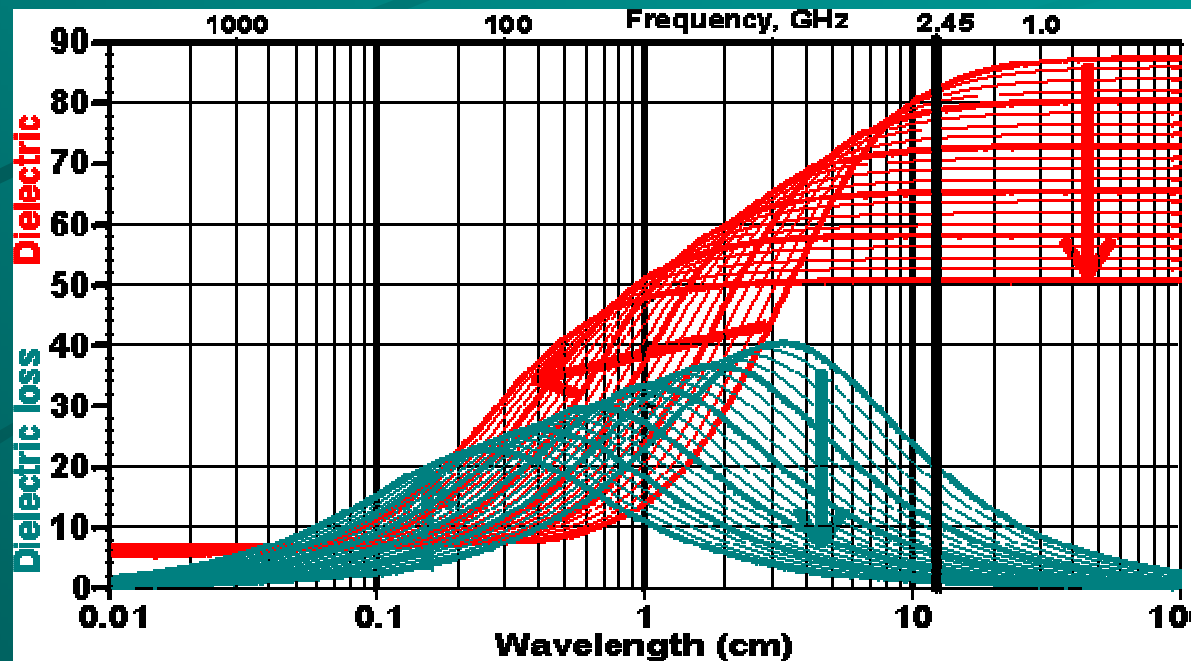


Interaction between water and microwaves

- ✦ *Water molecules are strongly polar and if soaked into an electromagnetic field, they start vibrating*
- ✦ *Knocking between water molecules causes friction heating and consequently evaporation*
- ✦ *Frequency of 2.45 GHz (wave length ≈ 12 cm) allows the higher water evaporation efficiency*



Working frequency



*Water hysteresis curve
(0-100 °C)*

Frequency of 2.45 GHz assures , as concerns water, the best solution between the capacity to absorb electromagnetic energy (dielectric permittivity) and transform it in heating ("Dielectric loss")



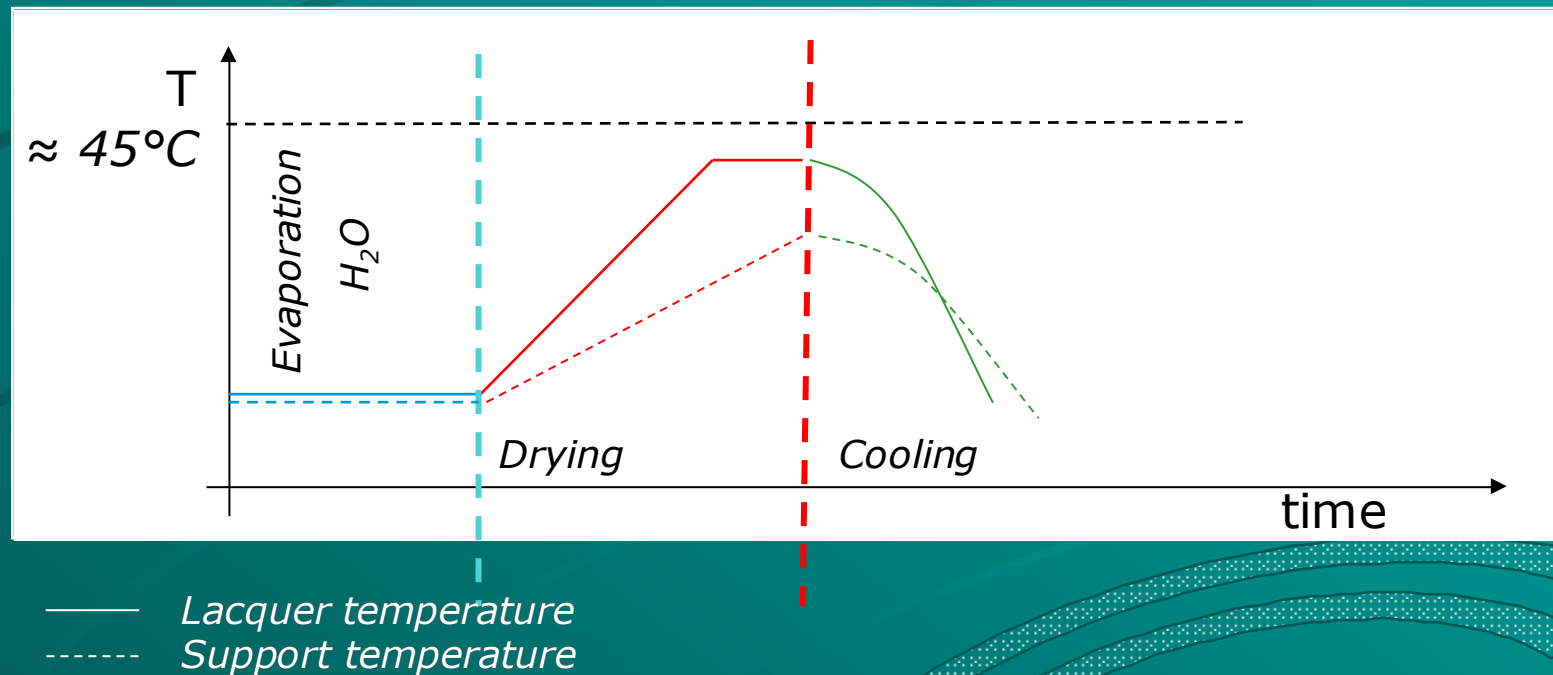
Penetrant microwaves power

Depth of microwaves penetration of 2.45 GHz concerning some materials

✦ Glass (20°C)	150 m
✦ Polyethylene	25 m
✦ Ice	12 m
✦ Pirex®	2 m
✦ Termoset	0.2 m
✦ Melamine	0.2 m
✦ Liquid water	30 mm
✦ Metals (Al)	2 µm

*Microwaves perfectly penetrate every kind of lacquer thickness.
Film thickness doesn't exert influence on the drying process.*

Drying curve MOS[®] – Hot air



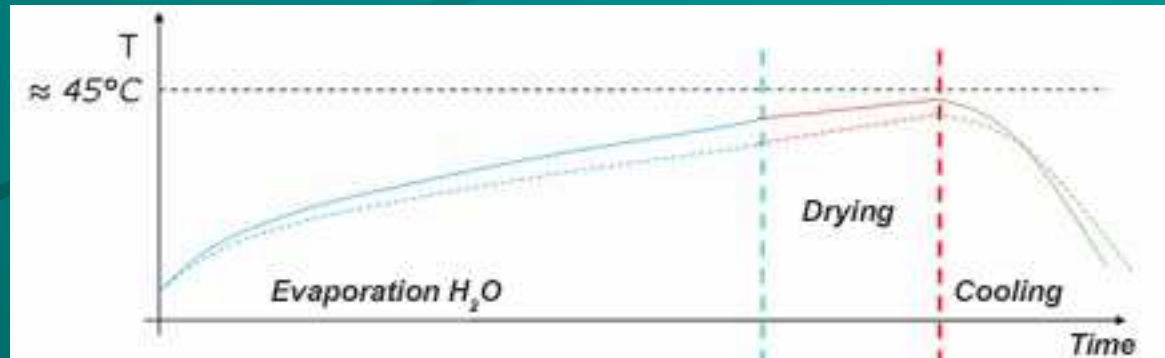
H₂O complete evaporation happens fast and without giving heating to the rest of the film. The gradual temperature increase allows the optimum distribution of the product and assures a better adherence of the product on the support.

Comparison with different technologies

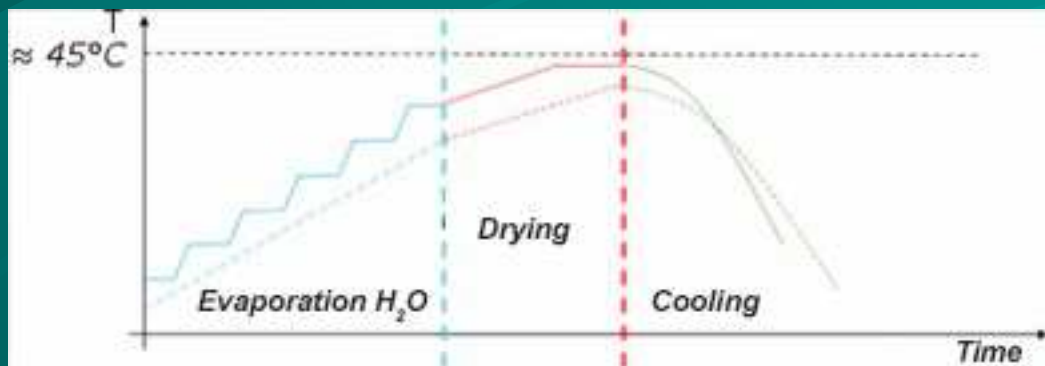


	M.O.S.[®]	IR + AC	Hot air
Drying time	Fast	Medium	Slow
Penetrating power	High	Scarce	Nothing
Dependence of PV thickness	Nothing	Low thickness are suggested	High thickness film
Seletctivity in power transferring	Best	Nothing	Nothing
Support heating	Nothing	High	Medium
Reticulation direction of the lacquer	Int - Ext	Ext -Int	Ext -Int
Tridimensionality	Best	Scarce	Good
Lighting - stopping	Istantaneous	1" - 10'	Impossible
Absorbed power	Low	High	High
Efficiency of energetic transfer	90%	60%	30%

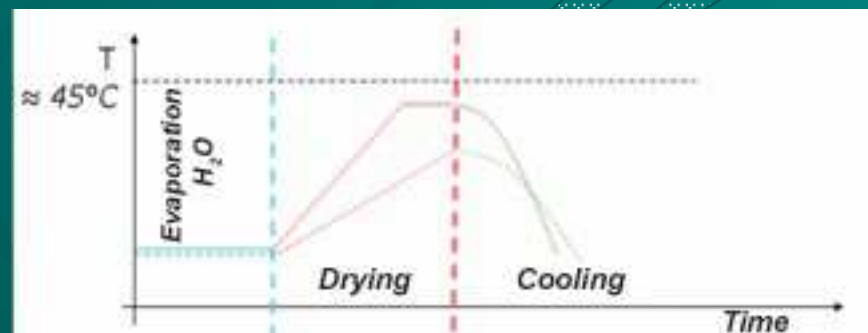
Comparison between drying curves



Hot air



**IR +
Hot air**



**MOS[®] +
Hot air**



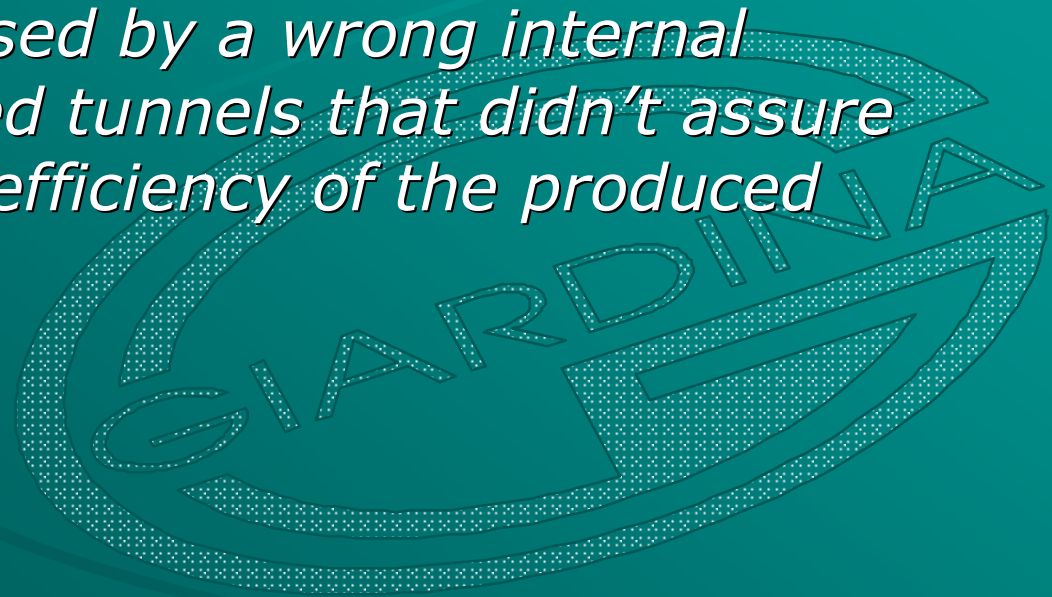
***MOS[®] industrial uses to dry wood
water-based lacquers***





Industrial uses of microwaves

- ✦ *The first industrial uses of microwaves drying have been tested in 1993, but they were unsuccessful.*
- ✦ *This failure was caused by a wrong internal design of the planned tunnels that didn't assure an optimal transfer efficiency of the produced power.*





Changes made by M.O.S.®

- + New internal configuration of the tunnel*
- + New transport system of microwaves – waves guide (patent pending)*
- + New system to neutralize microwaves at the inlet side of the permanent opening (patent pending)*
- + Adjustable frequency magnetron and continuously moving from the medium point (patent pending)*



*Clear increase of the
efficiency*





MOS[®] drying system advantages

TECHNOLOGICAL ADVANTAGES

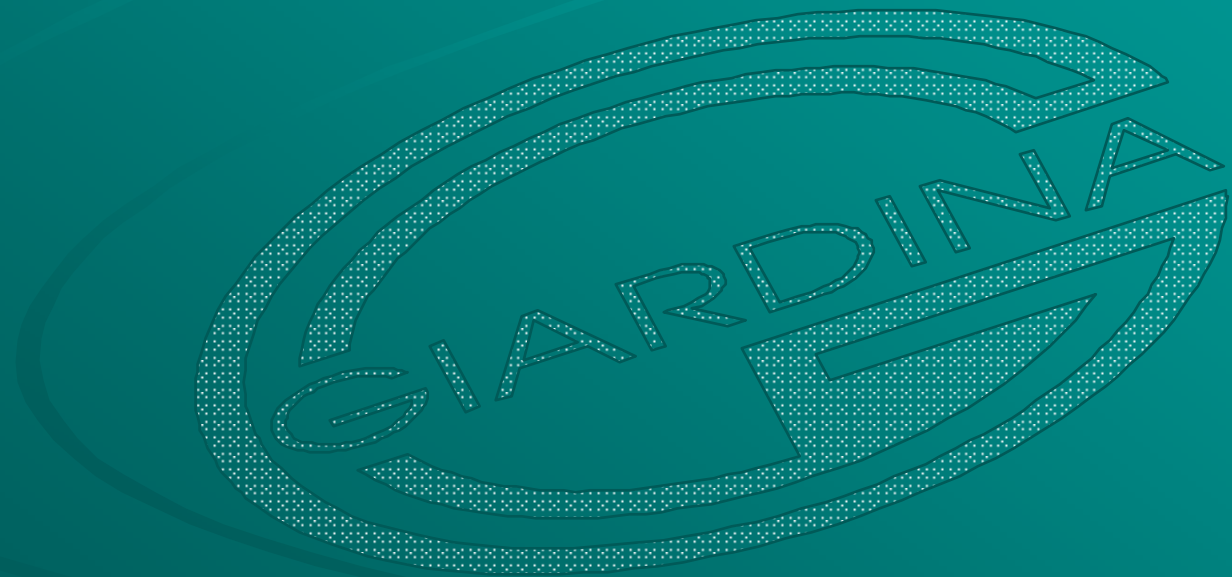
- ✦ Very fast drying time
- ✦ Selectivity in energy transfer
- ✦ Tridimensional omogeneity in power distributing in the internal part of the tunnel
- ✦ Instantaneous Switching on and off
- ✦ Reduced electrical consumptions
- ✦ Complete penetration in the lacquer film
- ✦ Capacity to dry every lacquer thickness

PERFORMANCE ADVANTAGES

- ✦ Control of the support temperature
- ✦ Less wood swelling
- ✦ No interaction between resins and microwaves
- ✦ Prominence of stains
- ✦ Reticulation starts from the interface support-lacquer and not from the external surface
- ✦ Better adherence and hardness
- ✦ Best transparence of the applied film



***MOS[®] installation
for flat pieces***





M.O.S.[®] and safety

MOS[®] system has two water attenuation phases that prevent microwaves emissions

	European law	American law
People's exposure limit	61 V/m	61 V/m
Workers' exposure limit	137 V/m	137 V/m
MOS [®] values found on its side area :		6-10 V/m*

**Analysis made by specialized laboratory EMILAB*

Emissions concerning every MOS[®] product are internally certified