

FREEZEWAVE PARTNERS

- ONIRIS-UMR GEPEA – CNRS 6144 - France
- SAIREM – SME – France
- RISE-Research Institute of Sweden
- TTZ Bremerhaven - Germany



FREEZEWAVE is an H2020 project

It was selected during the 2nd
ERANET Call “SUSFOOD”
(Sustainable Food).

2015 –2018.



PROJECT ABSTRACT:

FREEZEWAVE aims at understanding the effect of electromagnetic perturbation (Microwave - 2.45 GHz) on crystallization in the case of food freezing.

Each partner is equipped with a batch prototype freezer to optimize the technology for emulsion, fruit, vegetables, meat and fish .

In the end, an innovative microwave assisted freezing process will be developed to obtain high quality frozen food with optimized energy consumption.

Freezewave coordinator & contact:

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www.freezewave.eu



Freezewave



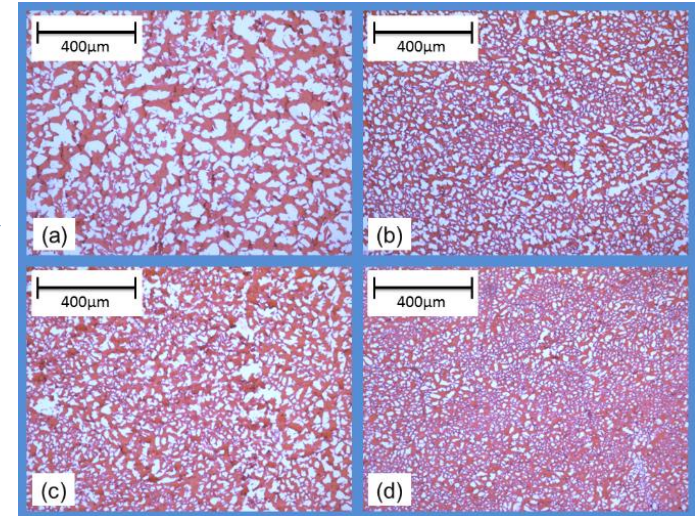
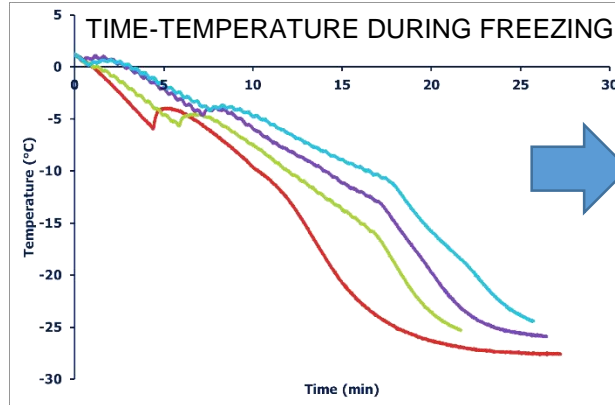
Innovative Process of Microwave Assisted Freezing (MAF)



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BACKGROUND

Time – temperature plots obtained during conventional freezing (red curve) and under different power levels of microwave radiation of pork tenderloin samples (40%/green - 50%/purple - 60%/blue curves). Low energy microwave is needed to affect crystallisation without overheating.



Microstructure of pork meat : a) control and b), c), d) with increasing microwave effect → increase in nucleation (Xanthakis et al. 2014).

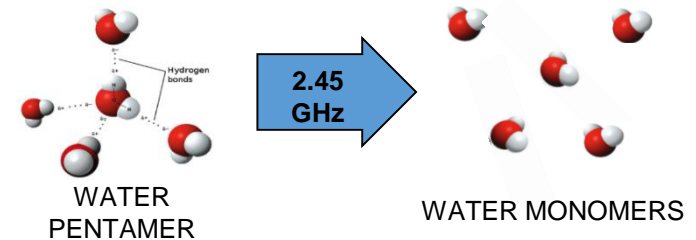
SCIENCE

→ MW at 2.45GHz are supposed to break down water pentamers (Hanyu et al. 1992)

Pentamers = 5 water molecules (85% of water is made of pentamers)

Breakdown of pentamers

- * ↘ chance of ice formation → ↗ supercooling
- * ↗ nucleation rate → Numerous and fine Ice crystals



PROJECT OVERVIEW

FREEZEWAVE CONCEPT:
 MICROWAVES DURING FREEZING
 → REFINEMENT OF ICE CRYSTALS
 → HIGHER QUALITY FROZEN FOODS

FREEZEWAVE CHALLENGES:
 -OPTIMIZING QUALITY vs ENERGY...

FREEZEWAVE OBJECTIVES:
 -Understanding freezing with microwaves
 -Batch process development
 -Continuous process development
 -Industry concepts & testing
 --Quality evaluation of MAF
 --Environmental impact assessment

MODELLING
 EMULSIONS FRUITS & VEG.

RTE MEALS & FISH

MEAT

EQUIPMENTS
 INDUSTRY CONCEPTS



- E. Xanthakis, A. Le-Bail, H. Ramaswamy (2014). Development of an innovative microwave assisted food freezing process. Innovative Food Science and Emerging Technologies 26, 176–181.
- Y. Hanyu, M. Ichikawa, Ü. Matsumoto (1992). An improved cryofixation method: cryoquenching of small tissue blocks during microwave irradiation. Journal of Microscopy 165, 255-271.