Baking of crust-less bread

In a microwave oven, food is heated up mainly by the interaction of the electromagnetic field with the water molecules inside the food. The non-uniform distribution of electrons in the water molecule creates a dipole moment. Inside an alternating electrical field, the water molecules are rotated with changing the orientation of the field. This movement creates heat. The high dielectric loss factor of water is the reason for fast heating of food inside a microwave oven.

The penetration depth of the microwave field in food is limited by the water content. In pure water at 20˚C, 66% of the microwave energy is absorbed inside the first 14 mm. When the temperature increases to 75˚C, the absorption zone is expanded to 59 mm. At the start of the process, the center of large parts is heated only by the flow of energy effected by the temperature difference between the microwave heated surface and the cold core. During the heating process the penetration depth increases because of vaporisation of water at higher temperatures.

It is possible with microwaves to cook food and also bread. The microwaves heat a product from the center toward the surface, while conventional ovens are work in the other direction. Typical baked bread, which is baked in 28 min in a conventional furnace, has the right structure and stability within only 10 minutes processing with a microwave. This microwave technology has been used for more than 8 years by a Linn High Therme customer in Thailand for baking of white crust-less bread. Eight Linn microwave continuous flow units (picture 1) with a length of 11 m and a width of 1, 5 m have a bread capacity up to 1200 kg / h. They output a total microwave power of 96 kW (8 microwave units at 12 kilowatts each). This corresponds to a total energy consumption of 165 kW by the unit at full power. This results in a savings of up to 40% of energy in comparison to conventional technologies.

Normally the crustless bread is baked and then the crust is removed, which is a waste of raw material and energy. The microwave baked bread is “normal” bread, but without a crust. The surface of the bread has thin white film, which is as smooth and elastic as the center of the bread. The bread is baked in microwave transparent (PP, PTFE) boxes. The boxes are placed on a special holding system, which is put on a conveyor belt for feeding into the microwave chamber Next, the boxes loaded with bread dough travel continuously on the conveyor belt through the microwave furnace. The patented microwave chamber with a round shape and the magnetrons placed helically around the chamber leads to a homogeneous heating, not only from the sides, but also from below.

There are other uses of this technology in the cakes and pastries industry: These include the baking of small cakes and the baking of dough for the production of the dry bread crumbs.

Pic. 1: Continuous Microwave Baking Ovens (Linn High Therm GmbH Model MDBT 12)

Pic. 2: Close-up of microwave baked crust-less bread