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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 45171-2024

**Determination of microwave heating temperature of plastics
materials and articles at the plastics food interface**

塑料类食品接触材料及制品在微波加热条件下与食品接触面温度的测定

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1 Scope

GB/T 45171-2024 gives the method for measuring the temperature reached at the interface between a plastic food contact article and the food during microwave heating. Migration limits for plastics are set at defined temperatures, and the assumption behind them is that the article never exceeds the temperature it was tested at; a microwave breaks that assumption, because the heating is volumetric and uneven and the surface touching a fatty food can run far above 100 degrees while the bulk is merely hot. Knowing the real interface temperature is therefore a prerequisite for choosing the migration test conditions. The standard describes the principle, the water used for the test, the equipment, the specimens and the procedure, with informative annexes on the probe position and an example temperature curve. It takes effect on 1 July 2025.

This document describes the method for measuring the temperature of plastic food contact materials and articles at the plastic food interface during microwave heating process. This document applies to the determination of the temperature of plastic food contact materials and articles at the plastic food interface under all foreseeable microwave heating conditions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 6682 Water for analytical laboratory use - Specification and test methods

3 Terms and definitions

For the purpose of this document, there are no terms and definitions that need to be defined.

4 Principle

Under the recommended power and heating time, use an optical fiber thermometer to determine the temperature rise curve of the temperature at the plastic food interface during microwave heating, use the data processing method specified in this document to determine the temperature at the plastic food interface during microwave heating and the migration temperature during migration test.

5 Water for test

Grade 2 water as specified in GB/T 6682.

6 Equipment

6.1 Polyethylene container Diameter $140 \text{ mm} \pm 20 \text{ mm}$, minimum volume 1000 mL.

6.2 Polystyrene foam pad Install to the bottom of the plastic container (6.1), thickness not less than 8 mm.

6.3 Thermometer Measuring range $-10 \text{ }^{\circ}\text{C} \sim 30 \text{ }^{\circ}\text{C}$, accuracy $\pm 1.0 \text{ }^{\circ}\text{C}$.

6.4 Constant temperature box Capable of maintain $10 \text{ }^{\circ}\text{C} \pm 0.5 \text{ }^{\circ}\text{C}$.

6.5 Microwave oven Flat-type special microwave oven. Rated output power $600 \text{ W} \sim 1000 \text{ W}$, equipped with fiber optic thermometer, measuring range $-20 \text{ }^{\circ}\text{C} \sim 200 \text{ }^{\circ}\text{C}$; the top of the microwave oven shall have a stirring hole to place the stirring rod.

6.6 Standard power electric heating equipment Electric heating equipment such as ovens with a determined input power value.

7 Samples

7.1 Determine the number of samples according to the number of probes of the fiber optic thermometer. If a fiber optic thermometer with one probe is used, it shall take at least 12 samples for parallel measurement; if a thermometer with 12 probes is used, it shall take at least 3 samples for parallel measurement.

7.2 Samples containing frozen foods shall be heated from a stable frozen state (about $-20 \text{ }^{\circ}\text{C}$); samples containing refrigerated foods shall be heated from a refrigerated state at $5 \text{ }^{\circ}\text{C}$.

7.3 Each sample shall contain food of the same or similar nature and have the same or

similar mass.

8.1.1 Determination of microwave oven output power

8.1.1.1 The output power of the microwave oven (6.5) used for temperature test is determined by measuring the time required for the temperature of 1000 g of water to rise by $10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

8.1.1.2 Place the polystyrene foam pad (6.2) at the geometric center of the microwave oven base. Use a constant temperature box (6.4) to keep the distilled water at $10\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$. Transfer $1000\text{ g} \pm 5\text{ g}$ of distilled water (5) to the polyethylene container (6.1), stir with a plastic stirring rod, and measure the water temperature with a thermometer (6.3). Place the container containing water in the center of the polystyrene foam pad (6.2), heat with the microwave oven (6.5) at maximum power, and stir the water rapidly until the water temperature rises by $10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. Record the water temperature and heating time, repeat the test twice, and take the average value.

8.1.1.3 The time for the water temperature to rise by $10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ shall be controlled within $50\text{ s} \sim 80\text{ s}$.

8.1.1.4 Calculate the output power of the microwave oven according to formula (1). where. W_m - the microwave oven output power, in watts (W); m_w - the water mass, in grams (g); ΔT - the actual water temperature rise, in degrees Celsius ($^{\circ}\text{C}$); t - the time required for water temperature rise, in seconds (s); 4.187 - the specific heat capacity of water, in joules per gram Kelvin [$\text{J}/(\text{g} \cdot \text{K})$].

8.1.1.5 When samples containing food is heated at a specific power instead of the maximum power, the above steps shall be completed at the specific power.