THE “PERFECT EGG” – A MEASUREMENT CHALLENGE

QUESTION: During a business trip to France, we were served a four-course dinner. The starter contained a fully peeled egg. When I cut into it, the white was firm and the yolk was liquid. Our French host told us this was the “perfect egg”. How can I cook such an egg?

Martin M

ANSWER: Cooking the “perfect egg” is based on being able to measure the temperature with sufficient accuracy and on understanding the field of heat transfer. In a hen’s egg, the egg white coagulates at a temperature of between 60 and 65 °C. For the yolk, the corresponding range is 65 to 70 °C. If you heat the egg to a temperature within the range of 60 till 65 °C, the white will set and become firm but the yolk will not. The heat problem is complicated by the fact that the white contains two different fractions with slightly different setting temperatures and phase transition heats. The relationship between the two fractions also depends on the egg’s age.

The egg can be suitably cooked in a water bath that maintains a constant temperature within the range of 60 to 65 °C. A water temperature of 63 or 64 °C is commonly used. The heating process must be controlled with a control system that keeps the water temperature constant. With the aid of a stirrer, the temperature variations in the water bath can be kept very small. The control system requires that you measure the water temperature. It is relatively easy to measure temperature in flowing water. With a calibrated sensor that is correctly installed, the measurement error is very small.

Preparing the “perfect egg” takes considerably longer than the time it takes to boil an ordinary egg, which is usually about five minutes. It takes almost an hour to cook the “perfect egg”. The time is determined by the difference between the water temperature and the egg white’s setting temperature, the thermal resistance between the water and the area inside the egg where the egg white is setting, and the phase transition heat. In this case, the temperature difference is very small, which is one reason why it takes a long time to prepare a “perfect egg”.

To cook the “perfect egg”, you can use the same equipment that is used for the “sous vide” cooking method. The term “sous vide” is French and means “in a vacuum”. The ingredients or food course are sealed in a vacuum, usually with plastic packaging. The method involves cooking the food at a specific temperature, and this is most easily done in a water bath. An advantage of this method is that the food can be prepared without using cooking fat and the aromas and nutrients are preserved. However, for safety’s sake, you should use an external sensor to check that the equipment can maintain a constant water temperature.

QUESTION ? ANSWER

Questions should be of general interest and be about temperature measurement techniques and/or heat transfer.

If you have questions or comments, contact Professor Dan Loyd, LiU, dan.loyd@liu.se