# 1.6: Crystallization

Many factors can influence crystallization in food. Controlling the crystallization process can affect whether a particular product is spreadable, or whether it will feel gritty or smooth in the mouth. In some cases, crystals are something you try to develop; in others, they are something you try to avoid. It is important to know the characteristics and quality of the crystals in different food. Butter, margarine, ice cream, sugar, and chocolate all contain different types of crystals, although they all contain fat crystals. For example, ice cream has fat crystals, ice crystals, and sometimes lactose crystals. The fact that sugar solidifies into crystals is extremely important in candy making. There are basically two categories of candies: crystalline (candies that contain crystals in their finished form, such as fudge and fondant); and non-crystalline (candies that do not contain crystals, such as lollipops, taffy, and caramels). Recipe ingredients and procedures for non-crystalline candies are specifically designed to prevent the formation of sugar crystals because they give the resulting candy a grainy texture. One way to prevent the crystallization of sucrose in candy is to make sure that there are other types of sugar—usually fructose and glucose—to get in the way and slow down or inhibit the process. Acids can also be added to “invert” the sugar, and to prevent or slow down crystallization. Fats added to certain confectionery items will have a similar effect.

When boiling sugar for any application, the formation of crystals is generally not desired. These are some of the things that can promote crystal growth:

- Pot and utensils that are not clean
- Sugar with impurities in it (A scoop used in the flour bin, and then used for sugar, may have enough particles on it to promote crystallization.)
- Water with a high mineral content (“hard water”)
- Too much stirring (agitation) during the boiling phase

Crystallization may be prevented by adding an interferent, such as acid (lemon, vinegar, tartaric, etc.) or glucose or corn syrup, during the boiling procedure. As mentioned above, ice cream can have ice and fat crystals that co-exist along with other structural elements (emulsion, air cells, and hydrocolloid stabilizers such as locust bean gum) that make up the “body” of the ice cream. Some of these components crystallize either partially or completely. The bottom line is that the nature of the crystalline phase in the food will determine the quality, appearance, texture, feel in the mouth, and stability of the product. The texture of ice cream is derived, in part, from the large number of small ice crystals. These small ice crystals provide a smooth texture with excellent melt-down and cooling properties. When these ice crystals grow larger during storage (recrystallization), the product becomes coarse and less enjoyable. Similar concerns apply to sugar crystals in fondant and frostings, and to fat crystals in chocolate, butter, and margarine.

Control of crystallization in fats is important in many food products, including chocolate, margarine, butter, and shortening. In these products, the aim is to produce the appropriate number, size, and distribution of crystals in the correct shape because the crystalline phase plays such a large role in appearance, texture, spreadability, and flavor release. Thus, understanding the processes that control crystallization is critical to controlling quality in these products.

To control crystallization in foods, certain factors must be controlled:

- Number and size of crystals
- Crystal distribution
- Proper polymorph (crystal shape)

Crystallization is important in working with chocolate. The tempering process, sometimes called precrystallization, is an important step that is used for decorative and moulding purposes, and is a major contributor to the mouth feel and enjoyment of chocolate. Tempering is a process that encourages the cocoa butter in the chocolate to harden into a specific crystalline pattern, which maintains the sheen and texture for a long time. When chocolate isn’t tempered properly it can have a number of problems. For example, it may not ever set up hard at room temperature; it may become hard, but look dull and blotchy; the internal texture may be spongy rather than crisp; and it can be susceptible to fat bloom, meaning the fats will migrate to the surface and make whitish streaks and blotches.