

## TEMPERED CHOCOLATE BRITTLE



Engineer the perfect chocolate brittle to gift to friends, family, or yourself, with this special valentine's recipe from mechanical food engineer **Dr Idris Kevin Mohammed**, teaching fellow at Imperial College London.

### What is tempered chocolate?

Tempering in metallurgy is a technique which involves the heating and cooling of a metal, such as steel, to improve mechanical properties such as hardness and toughness. The same principle is true for chocolate!

Chocolate is tempered to control the crystal size and structure of the cocoa butter which results in solid chocolate which has a glossy surface finish, fractures when snapped and melts at human body temperature.

### What you'll need

#### Equipment

- Heatproof (ceramic) mixing bowl to create a bain-marie
- Pot (smaller diameter than the bowl)
- Mixing spoon
- Silicone moulds or baking tray and greaseproof paper
- Knife (maybe)
- Thermometer (optional)

#### Materials

- Chocolate chips or bar of chocolate (can be dark or milk, as long as it has cocoa butter)
- Your choice of toppings for your chocolate brittle (chopped nuts, dried fruit, sweets, or if you're feeling fancy freeze-dried raspberries)



## Method

### Action

1 Lay out your silicone mould or line your baking tray with the greaseproof paper.

At this temperature all 6 forms of chocolate crystals are melted.

2 Heat a half-filled pot of water to 45C.

3 If you have a chocolate bar, then use a knife to cut/chop into chocolate chips.

Smaller chocolate chips increase the surface area which is proportional to the heat transfer rate, allowing the chocolate to melt faster.

4 Add most (three-quarters) of the chocolate chips into the heatproof mixing bowl and place above the pot of water.

In culinary science, this setup is referred to as a 'bain-marie'. In an engineering lab, this would be called a water-bath.

5 Continuously mix the chocolate chips until they are all melted.

Agitating the molten chocolate helps to evenly distribute the cocoa butter crystals throughout the mixture.

6 Carefully remove the bowl from the heat using oven gloves.

7 Add the remainder of the chocolate chips into the bowl of molten chocolate and mix until they are melted.

This process, known as seeding, uses the crystals from the solid chocolate to induce crystal formation in the molten chocolate. Due to the thermal gradient between the molten chocolate and chips, the overall temperature of the mixture is lowered.

8 Place the bowl back on the pot for a few minutes add your toppings of choice and stir with spoon.

9 Pour the melted chocolate mixture into silicone mould or baking tray.

Rapidly cooling (in fridge) or slowly cooling (in air) will result in different chocolate microstructures and hence affect the snap.

10 Leave the mould out to cool to room temperature until it solidifies.

11 Remove the now solidified chocolate from the mould.

A successful tempered chocolate will look shiny, fracture in a brittle manner with a sound when snapped and have a smooth texture (melt in your mouth). An unsuccessful tempered chocolate will have a dull appearance, deform in a ductile manner when snapped and have a chewy texture.

12 Now snap the chocolate into a mix of small and large pieces.

13 Eat it!

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## Surprising similarities between chocolate and steel!

Chocolate has 6 different crystal structures which result in different properties. Steel has 2 crystal structures with multiple phases which affects its hardness, strength and toughness.

Molten chocolate can be rapidly cooled, air cooled or slowly cooled. When performing heat treatments of steel, these terms are referred to as quenching, normalising and annealing respectively.

In the chocolate industry, the eutectic effect causes chocolate to melt at a lower temperature than the average of the cocoa butter and fats. The eutectic point in steel occurs at a specific carbon content and temperature such that the liquid phase is in equilibrium with two solid phases.

When tempering chocolate, the chocolate is melted. However, during the tempering of steel, the temperature is kept below its melting point.

## Other things you can make with tempered chocolate

For a more unique taste, instead of sprinkles you can add liquor such as rum or brandy. However, add the liquor in with the chocolate chips at the start of the process. If water comes into contact with melted chocolate, the water will form a syrup with the sugar which then clings to the cocoa particles, resulting in a lumpy structure.

### Fun Fact:

**Chocolate liquor: Thick paste-like mass made of pure cocoa solids and cocoa butter.**

**Chocolate liqueur: Beverage made from a base liquor like rum to which chocolate is added.**

**Liquor: Distilled alcoholic drink such as rum. Chocolate liqueur is a type of liquor.**



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