

## Hot Working

If the metalworking process is carried out above its re-crystallization temperature, it is called as **hot working**.

Re-crystallization temperature is the temperature at which atomic mobility can be repaired when any defect was present in the metal caused by the working process.

In this process, the metal is heated to the plastic state, and then the pressure is applied to get various size and shapes. When the pressure is applied, the metal grain size will be varied, and the metal's mechanical properties are improved.

If the pressure is applied by hand hammer, then it is called as hand or **smith forging**. If hand hammering is replaced by power hammers, then it is called **hammer forging**.

Such type hot working of metals is called as **hot forging**. Hot-working can be used for forging, extrusion, and drawing, etc.

When metals are worked above the re-crystallization temperature, then it becomes plastic and causes the growth of grains.

During the hot working, the grains become loosened in their structure, and they realign in a proper manner. Only small pressure is required to shape the metal.

### **Advantages of Hot Working.**

1. It is applicable for mass production work.
2. The metal size and shape can be easily changed.
3. Metalworking is done under high temperature; therefore, larger deformation is possible.
4. Metal grain structure will be refined.
5. Stresses and other defects can be minimized.

6. Hot-working leads to homogeneous structure of metal without defects and blowholes.
7. Mechanical, physical, and chemical properties of metals can be improved.
8. Hot working removes all types of imperfections caused by the Gas pores and composition differences.
9. Metal reaches to anisotropic behavior.
10. Metal regains softness and ductility after the process.
11. Hot working is a fast, reliable, and economical process.

### **Disadvantages of Hot working.**

1. It is a costlier process.
2. Hot working leads to poor surface finish due to oxidation, because the material will be worked under high temperature.
3. Sometimes it leads to lower strength due to loss of carbon due to oxidation.
4. On account of the loss of carbon from the surface of the steel piece being worked, the surface layer loses its strength, which is a disadvantage when the part is put to service.
5. It is difficult to attain dimensional accuracy due to uneven shrinkage of metal.

## Cold Working

If the metalworking process is carried out at a temperature below the re-crystallization temperature, it is called a cold working process.

This process needs comparatively higher pressure than hot working.

Soft, ductile, and malleable metals can be easily worked with cold working. But this process leads to hardness and distorted grain structure.

The cold working process is used in rolling, bending, spinning process, etc.

The cold working process also affects the following mechanical properties of metals significantly.

1. Hardness.
2. Yield Strength.
3. Ductility.
4. Tensile Strength.

Watch the video below for better understanding.

### **Advantages of Cold Working.**

1. Dimensional accuracy can be maintained.
2. No heating of metals.
3. Better surface finish can be achieved since there is no oxidation during the cold working of metals.
4. Strength and hardness of the metal are increased.
5. Due to cold working, metal gains strength and hardness.

6. Better strength and wear properties of the material can be achieved.

### **Disadvantages of Cold Working.**

1. It leads to brittleness if the metals are worked under cold working.

2. Metals hardness is increased.

3. Cold worked components require a heat-treatment process.

4. Only ductile and malleable materials are suitable for cold working.

5. Greater force is essential for deformation. Therefore powerful machines are required.