What is mechanical properties?

The mechanical properties of metals determine the behavior of materials to withstand the action of external forces.

1. Stress is the resistance inside the metal against external force. We classified into 5 categories:-

1.1 **Tensile stress** (or tension) is the stress state leading to expansion; that is, the length of a material tends to increase in the tensile direction.
1.2 **Compressive stress** is the stress applied to materials resulting in their compaction (decrease of volume).
1.3 **Shear stress** is defined as a stress which is applied parallel or tangential to a face of a material.
1.4 **Bending** (also known as **flexure**) stress characterizes the behavior of a structural element subjected to an external load applied perpendicular to the axis of the element.
1.5 **Torsion stress** is the stresses induced on a member as a result of torsion

2. Stain in metal encourage of deformation to the direction of applied force such as elongation or contraction. It can be classified into 3 categories:-

2.1 **Tensile Stain** is pulling stain caused by tensile force against the work piece.
2.2 **Compressive Stain** is the stain applied to materials resulting in their compaction.
2.3 **Shear Stain** is defined as a stress which is applied parallel or tangential to a face of a material.

3. Elasticity / Flexibility

Elasticity is that property that enables a metal to return to its original shape when the force that temporary causes the change of shape is removed. This property is extremely like spring.

4. Ductility

The ductility of a metal is the property that allows it to be stretched or otherwise changed in shape without breaking and to retain the changed shape after the load has been removed for example gold.

5. Brittleness

Brittleness is the property of a metal that allows little bending or deformation without shattering such as cast iron, glass. In other words, a brittle metal is apt to break or crack at 5% of stress or any metals was broken before 5% of stress we determine that metals are more brittle.

6. Toughness

The ability of a metal to rapidly distribute within itself the 5% both of stress and strain caused by a suddenly applied load, or more simply expressed, the ability of a material to withstand shock loading.

7. Strength

The strength of a metal is its ability to withstand the action of external forces without breaking. Ultimate tensile strength and ultimate compressive strength also called ultimate strength, is the maximum strength developed in a metal in a tension test. We may see the Stress-Stain Curve at the breaking point.

8. Stiffness

Stiffness is the resistance of an elastic body to deflection or deformation by an applied force within elastic limit. During loading period, the stiffness value shall be varied according to Modulus of Elastic and Rigidity.

9. Plasticity

Plasticity generally means ability to permanently change or deform in shape without breaking. It was very most important for Rolling Extruding and Drawing.

10. Fatigue

Metal fatigue is caused by repeated cycling of the load. It is a progressive localized damage due to fluctuating stresses and strains on the material. Metal fatigue cracks initiate and propagate in regions where the strain is most severe.

11. Creep

Creep is the tendency of a solid material to slowly move or deform permanently under the influence of stresses and continuous loads or at high temperatures caused its atom removable inside the metal until the metal was broken.

12. Hysteresis

Hysteresis is the lag between making a change such as increasing or decreasing power at the response or effect of that change typically refers to turn on and turn off point in electrical, electronics and mechanical systems.

Reference from http://www.mtec.or.th/th/labs/mech/index.html