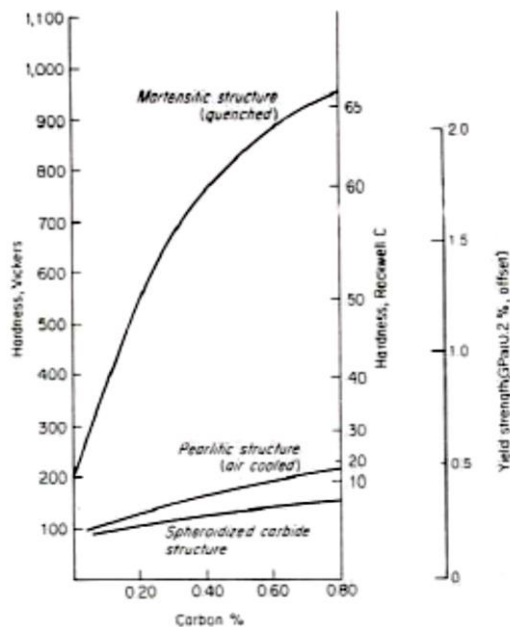


Martensite Strengthening

- Martensitic strengthening is obtained when austenite is transformed into martensite by a diffusionless shear-type process in quenching.
- Martensitic transformation occurs in many alloy systems but steels has shown the most pronounced effect.

High strength of martensite is due to two main contributions;

- Slip barriers from (1) conventional plate martensite structure with a unique habit plane and an internal parallel twins of each 0.1 mm thick within the plate and (2) Block martensite structure containing a high dislocation density of 10^9 to 10^{10} mm^{-2} .
- Carbon contents ($<0.4\%$) lead to carbon atom clustering and dislocation interaction → increased strength and hardness, see fig.

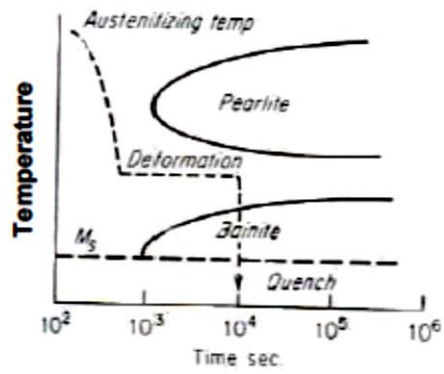


Ausforming process

Ausforming is a thermo-mechanical process where steel is plastically deformed ($>50\%$) usually rolling and then quenched to below the M_s to form martensite.

Temperature TTT diagram showing steps in ausforming process.

- Plastic deformation of austenite should be done without transformation to pearlite or bainite.
- Highest strengths are achieved by the greatest possible deformation at the lowest temperature at transformation does not occur.



- Uniformly distributed dislocations of high density (10^{11} mm^{-2}) and precipitation provides sites for dislocation multiplication and pinning, contribute to very high strength (2-3 GPa) with 40-20% RA.