Engineering Materials

University Mechanical Engineering · Vocabulary in context

Word	Example
engineering materials	Compare **engineering materials** by their structure, processing and properties.
low-carbon steel	**Low-carbon steel** is easy to bend and weld, so it is used for car bodies.
crystal structure	Iron and aluminium have different **crystal structure** types at room temperature.
atomic packing factor	The **atomic packing factor** is the share of a unit cell filled by atoms.
dislocation	A moving **dislocation** allows layers of atoms to slip.
grain boundary	A **grain boundary** separates crystals with different orientations.
grain refinement	Within the usual range, **grain refinement** can increase yield strength.
engineering stress	Calculate **engineering stress** using the specimen's original cross-sectional area.
true stress	Calculate **true stress** using the current cross-sectional area.
Young's modulus	Steel has a high **Young's modulus**: it is very stiff.
yield strength	The **yield strength** marks the onset of significant permanent deformation.
toughness	**Toughness** measures energy absorbed per unit volume before fracture.

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ductility /dʌkˈtɪlɪti/	**Ductility** lets copper be pulled into wire.
phase diagram	A **phase diagram** shows which phases exist at each temperature and mix.
eutectoid	At the **eutectoid** reaction, one solid phase becomes two solid phases.
pearlite	**Pearlite** contains alternating layers of ferrite and cementite.
martensite	Rapid cooling can form hard **martensite** in suitable steel.
lever rule	Use the **lever rule** to calculate equilibrium phase fractions.
strain hardening	Cold working can increase strength through **strain hardening**.
precipitate /prɪˈsɪpɪteɪt/	A fine **precipitate** can obstruct dislocation motion.
composite /ˈkɒmpəzɪt/	This **composite** combines strong fibres with a supporting matrix.
rule of mixtures	Use the **rule of mixtures** to estimate composite properties.
viscoelasticity	**Viscoelasticity** combines elastic response with time-dependent deformation.
glass transition	Near the **glass transition**, an amorphous polymer becomes less stiff.
ceramic	This **ceramic** resists compression but fractures with little plastic deformation.

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Weibull modulus	A higher **Weibull modulus** means less scatter in measured strength.
heat treatment	Choose **heat treatment** to change the steel's structure and properties.
quenching	**Quenching** cools heated steel rapidly.
tempering	**Tempering** reduces brittleness in quenched steel.
casting /ˈkæstɪŋ/	In **casting**, molten material solidifies inside a mould.
solidification /səˌlɪdɪfɪˈkeɪʃn/	Cooling the molten metal causes **solidification**.
fatigue /fəˈtiːg/	Metal **fatigue** makes a part crack after it bends many times.
reversal	In full stress **reversal**, the load swings from tension to equal compression.
endurance limit	Below its **endurance limit**, steel can survive an unlimited number of stress cycles.
corrosion /kəˈrəʊʒn/	**Corrosion** slowly eats away the metal.
material index	Use a **material index** to compare candidates for a stated design.

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