

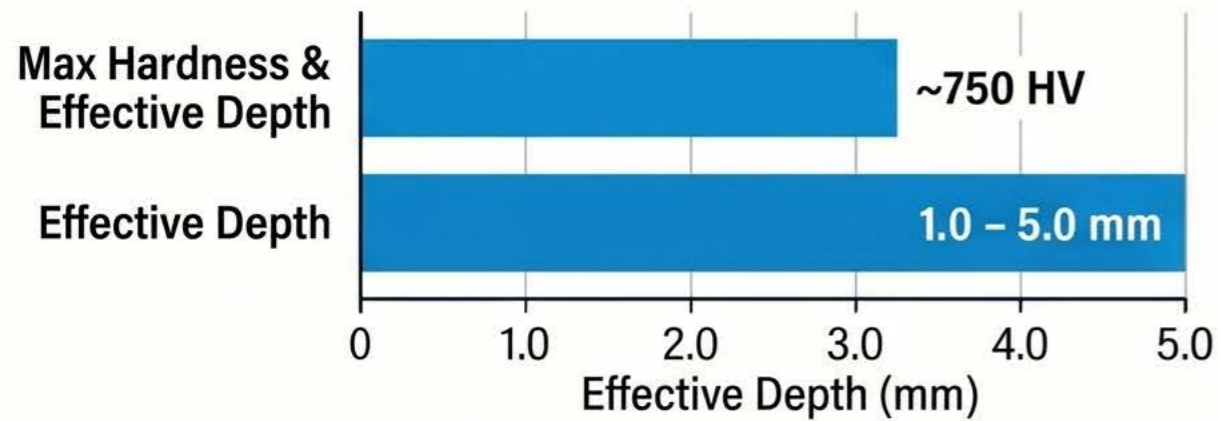
Boosting Durability: Comparing Surface Hardening for Fatigue Life

Surface treatments like surface hardening, carburising, and nitriding prevent fatigue failure by increasing surface mechanical strength and generating beneficial residual compressive stresses.

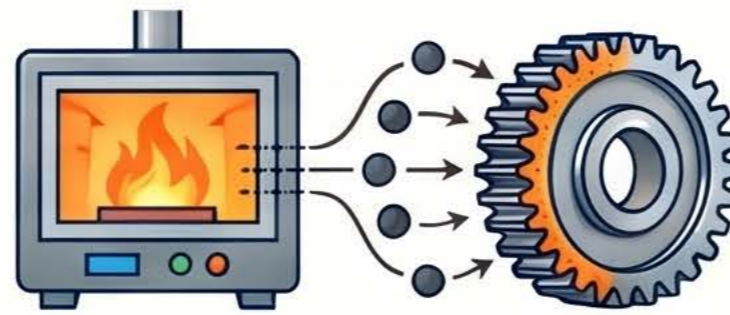
Surface Hardening (Thermal)



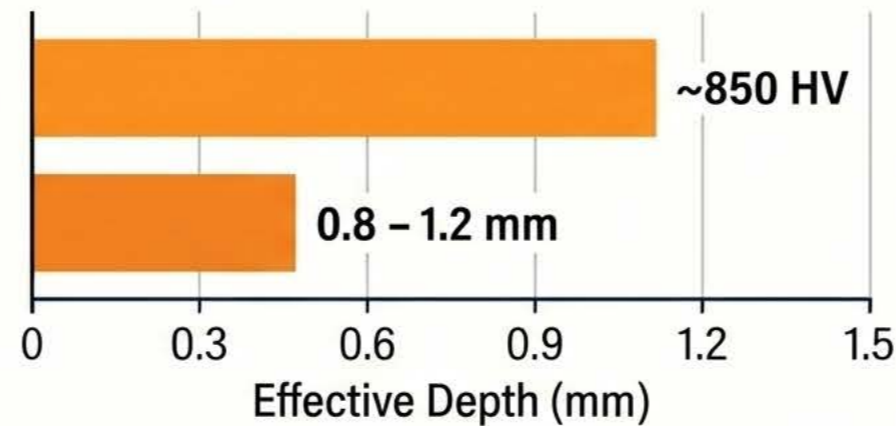
Uses induction or laser heating to create a hard martensitic surface layer.



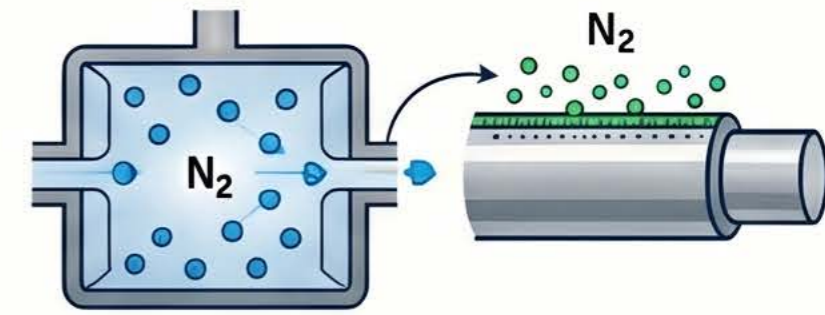
Carburising (Thermochemical)



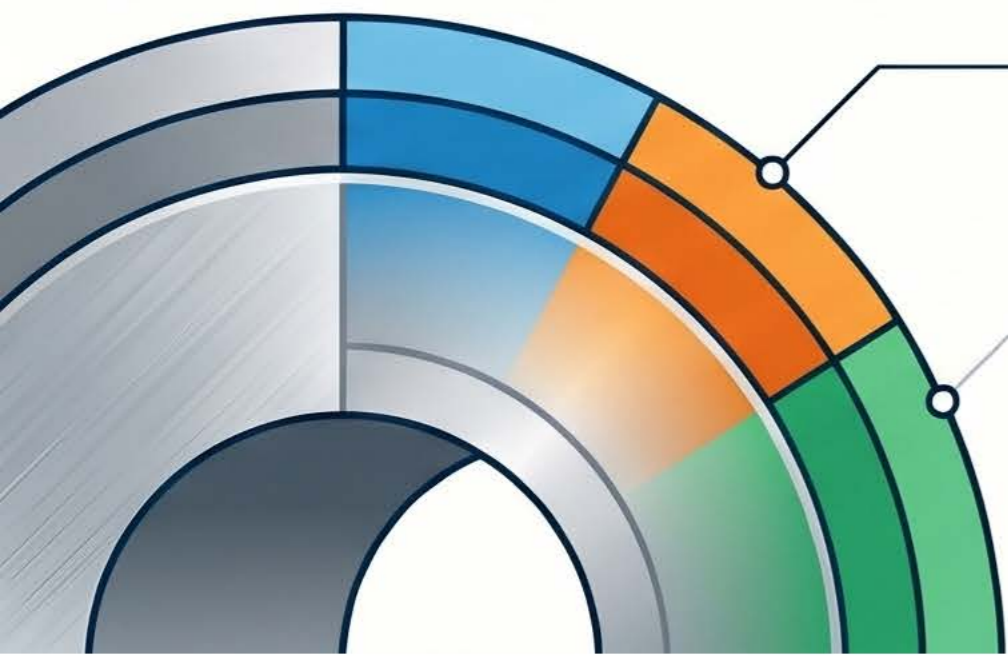
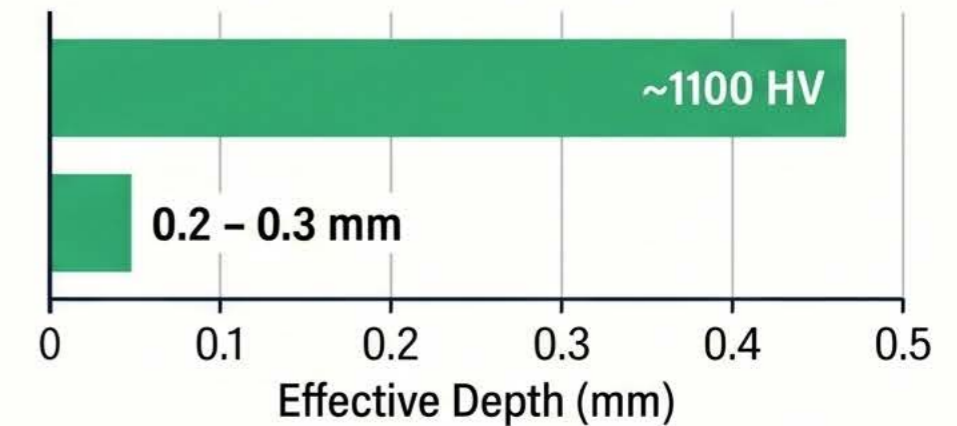
Enriches low-carbon steel surfaces with carbon to achieve high hardness through quenching.



Nitriding (Thermochemical)



Introduces nitrogen to form fine particles, hardening the steel through precipitation mechanisms.



Enhancing Fatigue Resistance

Residual Compressive Stresses

Treatments create internal surface compression that effectively "closes" potential fatigue cracks.



0.5 Fatigue-to-Strength Ratio

Steel fatigue limits generally remain between 45% and 50% of ultimate tensile strength.



Strategic Crack Management

Proper treatment shifts crack initiation from the surface to the stronger core material.