

Von Mises or Tresca?

Mechanical Engineering

The two yield criteria for ductile metals, and where each is used.

Von Mises

- Distortion energy criterion
- Matches ductile test data closely
- Plane stress: $\sqrt{(\sigma_1^2 - \sigma_1\sigma_2 + \sigma_2^2)}$
- Smooth surface, easy to work with

Tresca

- Maximum shear stress criterion
- Always the more conservative
- Yields when $\sigma_1 - \sigma_3$ reaches S_y
- Simple, and used in vessel codes

THE DIFFERENCE THAT MATTERS

Ductile metals: von Mises for design, Tresca whenever the code calls for it.

Both describe ductile yielding. Brittle materials fail on maximum principal stress instead.