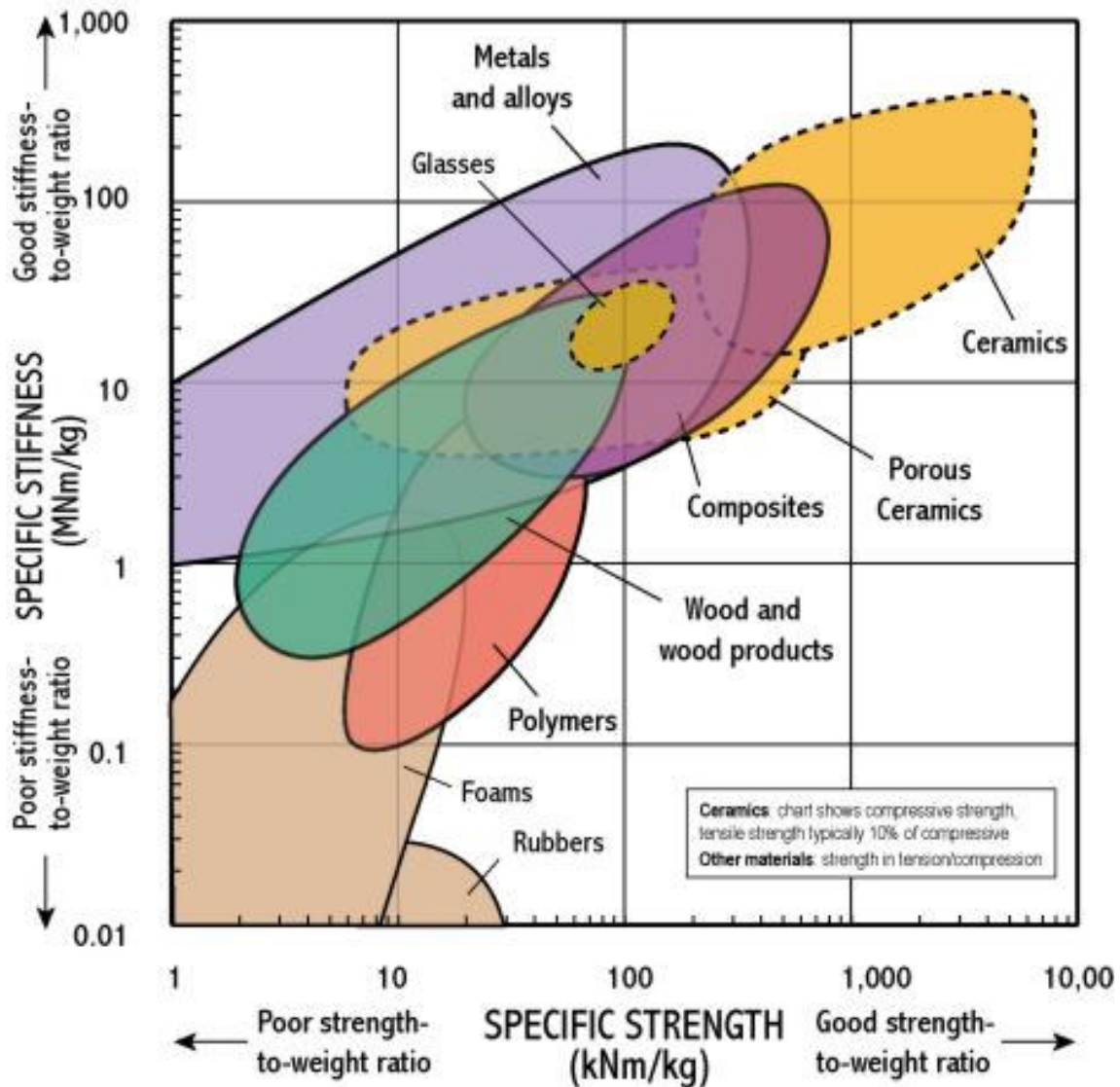


Specific stiffness - Specific strength



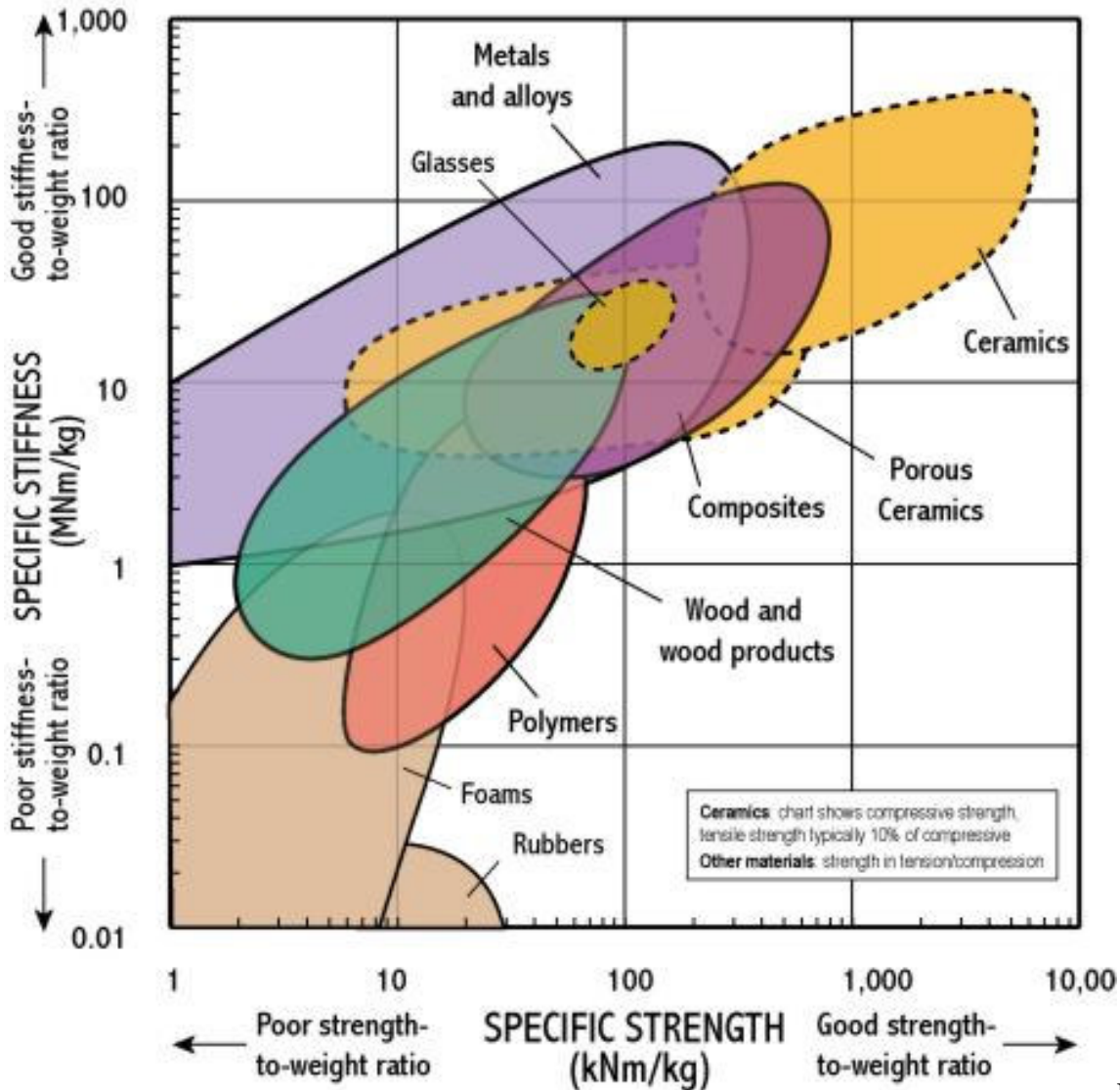
General Information

- Specific properties are properties that have been divided by the material density.
- This chart is useful for identifying materials for components which require high stiffness and/or strength combined with low weight
- Composites provide a means of achieving good specific properties.

Physical Insights

- The bubbles are elongated along the specific strength axis, but not specific stiffness. This is because alloying and heat treatments have a strong effect on strength but little on stiffness and density
- Note that high strength and high stiffness often go together - this is because they are both largely controlled by the atomic bonding

Specific stiffness - Specific strength



Example

Uses

- Bicycle frames require high specific stiffness to prevent bending and high specific strength to prevent failure, at low weight
- Aircraft have many aluminium structures because they offer low weight at sufficient strength and stiffness

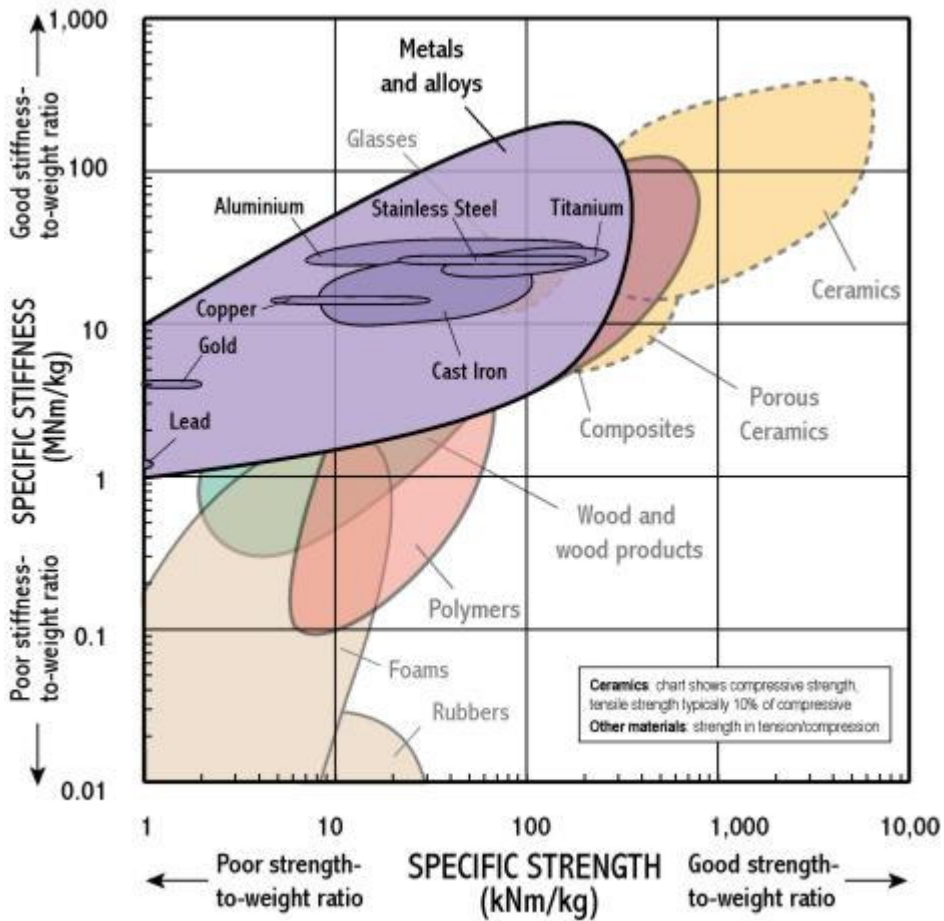
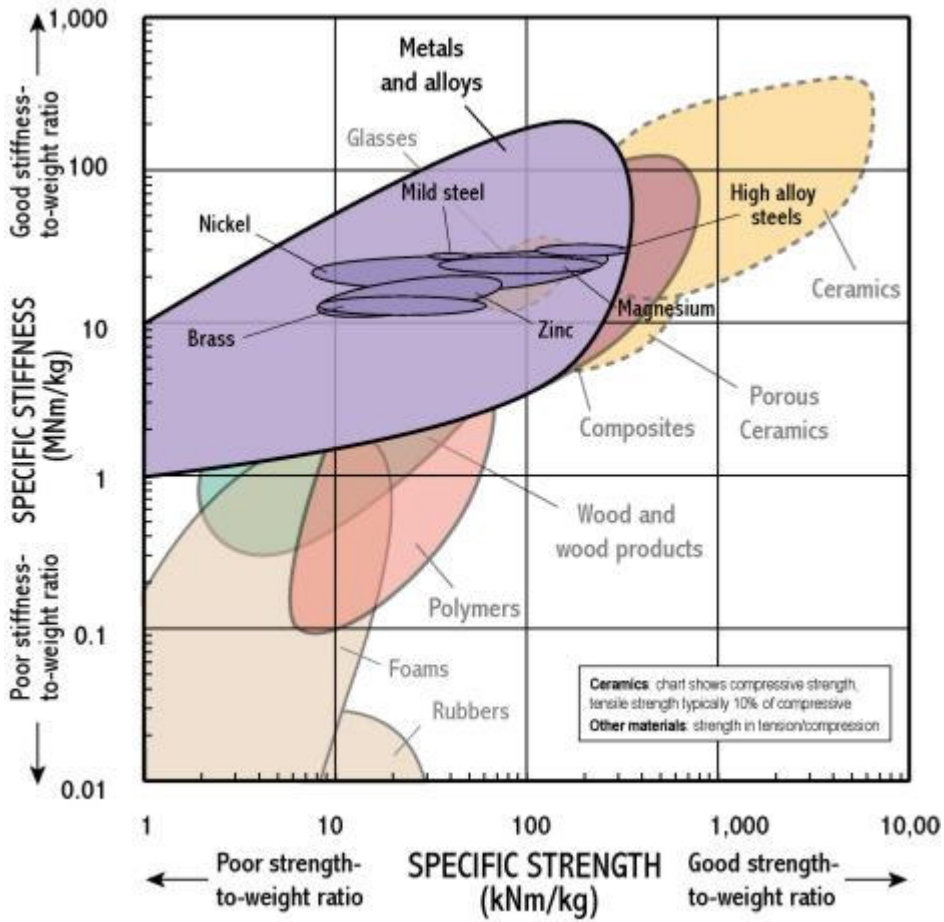
Simple Questions

- Explain why bike frames are made from steel, aluminium alloy or carbon-fibre reinforced plastic?
- Select materials for a tennis racquet.
- Select materials for a canoe.
- Select materials for a cast for a police truncheon.

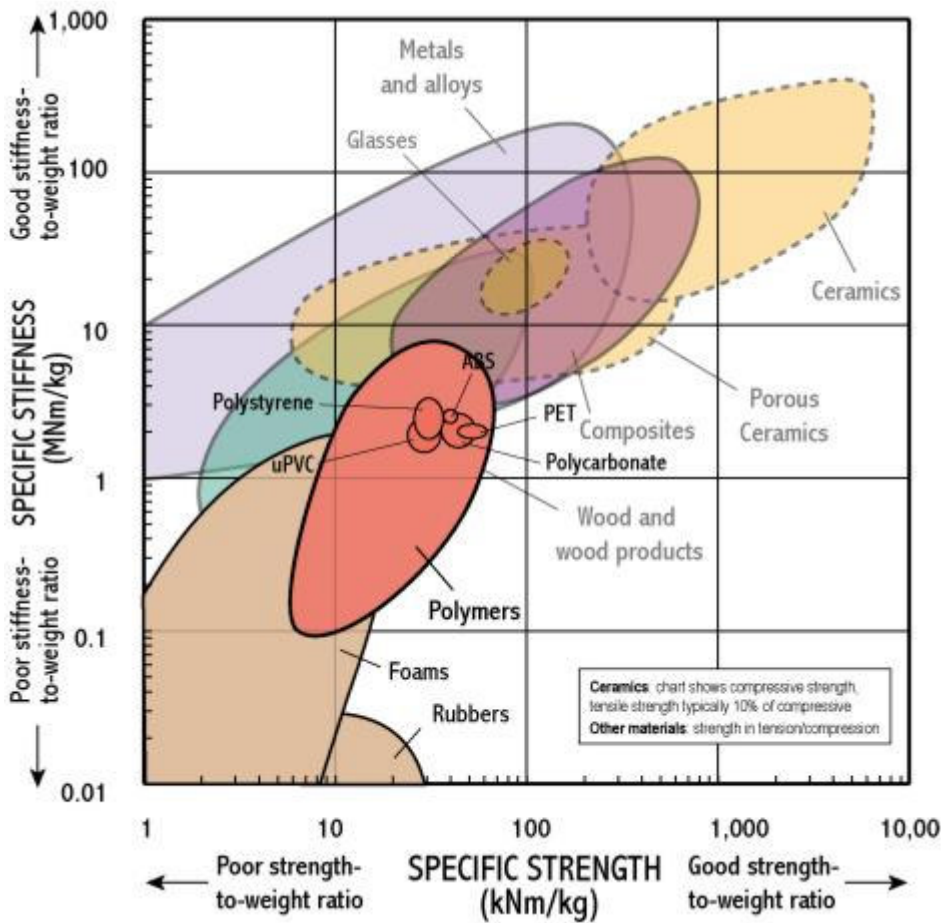
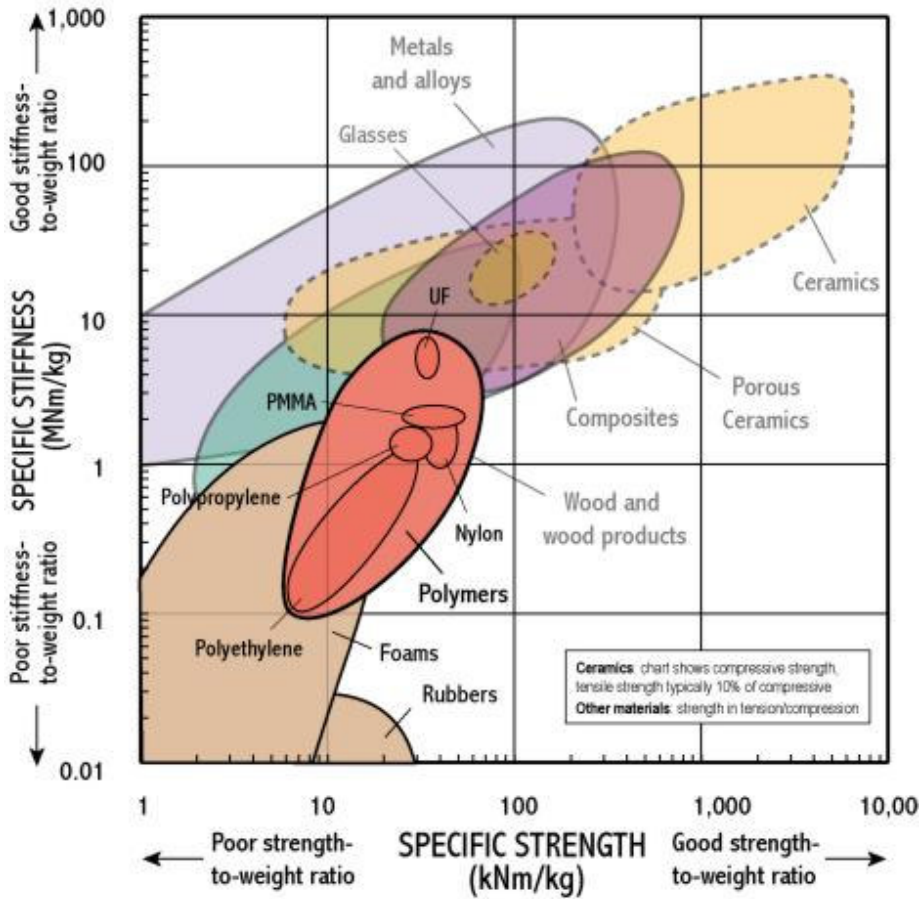
Further Questions

- Why are cast-iron cooking pans among the best when they are the heaviest?
- Why are composites used more widely for sports goods than elsewhere?

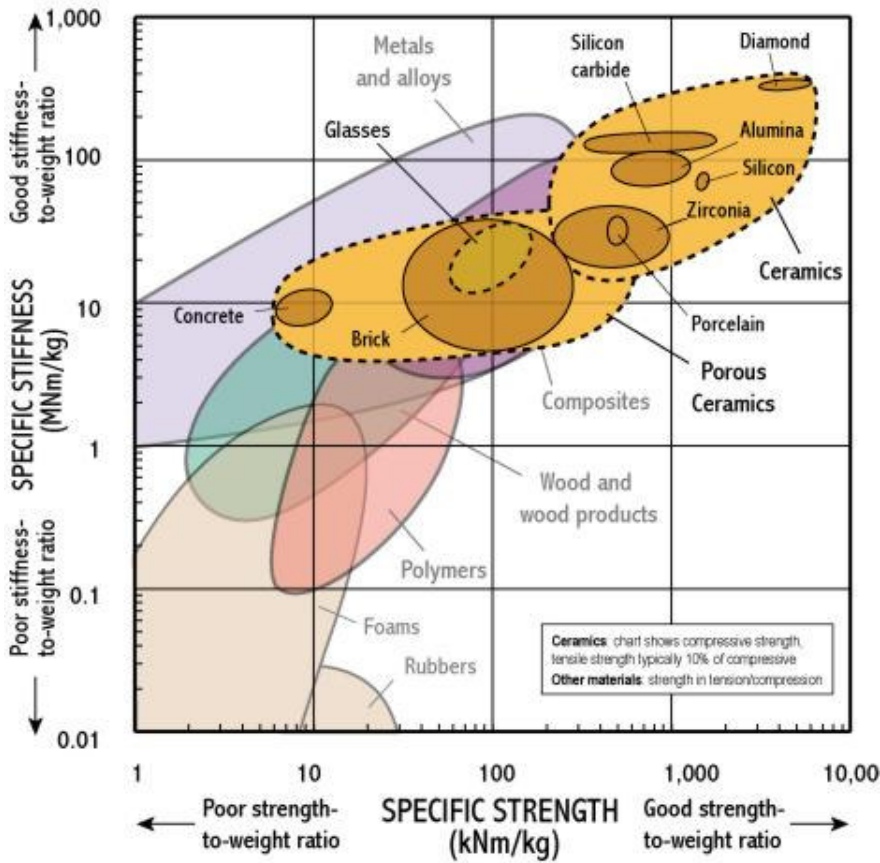
Metals and alloys



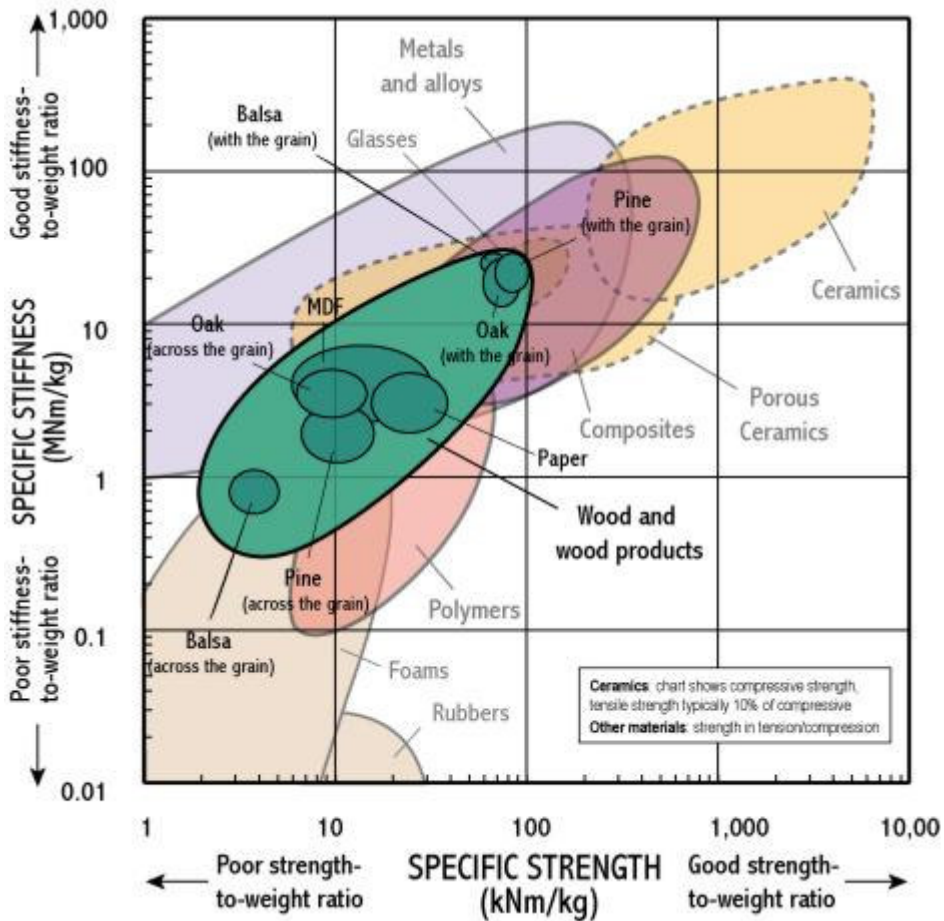
Polymers



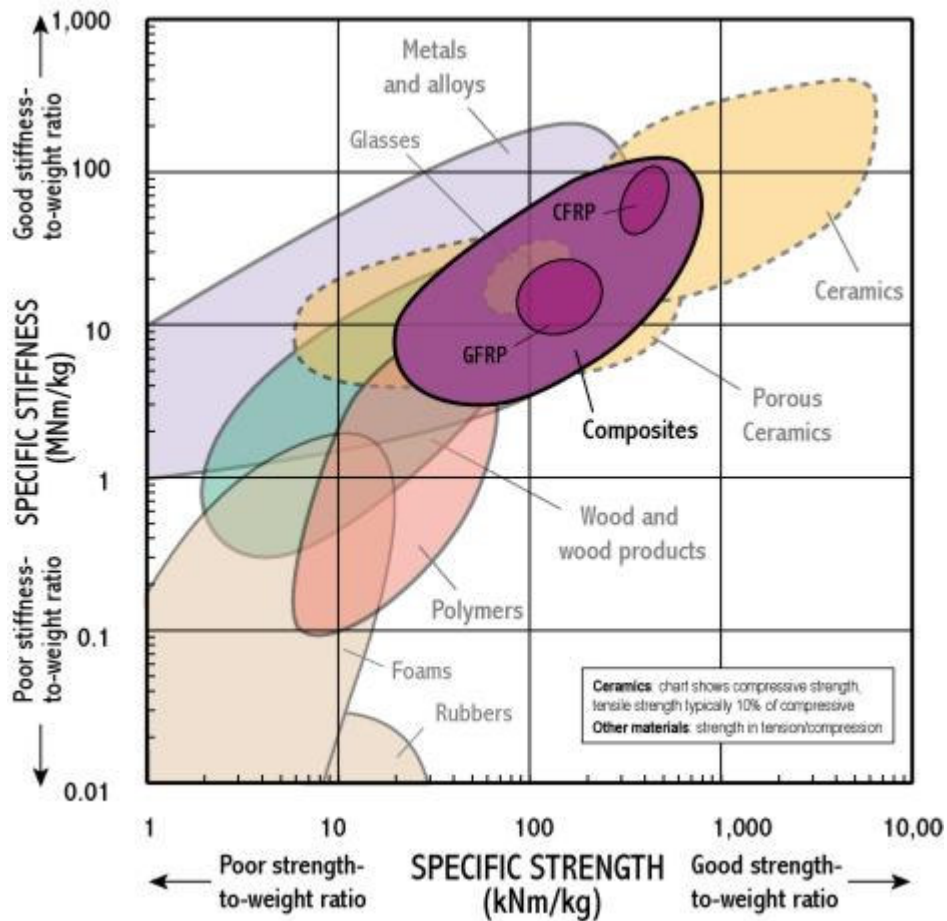
Ceramics



Wood and wood products



Composites



Select chart:

- [Young's modulus - Density](#)
- [Young's Modulus - Cost](#)
- [Strength - Density](#)
- [Strength - Toughness](#)
- [Strength - Elongation](#)
- [Strength - Cost](#)
- [Strength - Max service temperature](#)
- [Specific stiffness - Specific strength](#)
- [Electrical resistivity - Cost](#)
- [Recycle Fraction - Cost](#)
- [Energy content - Cost](#)