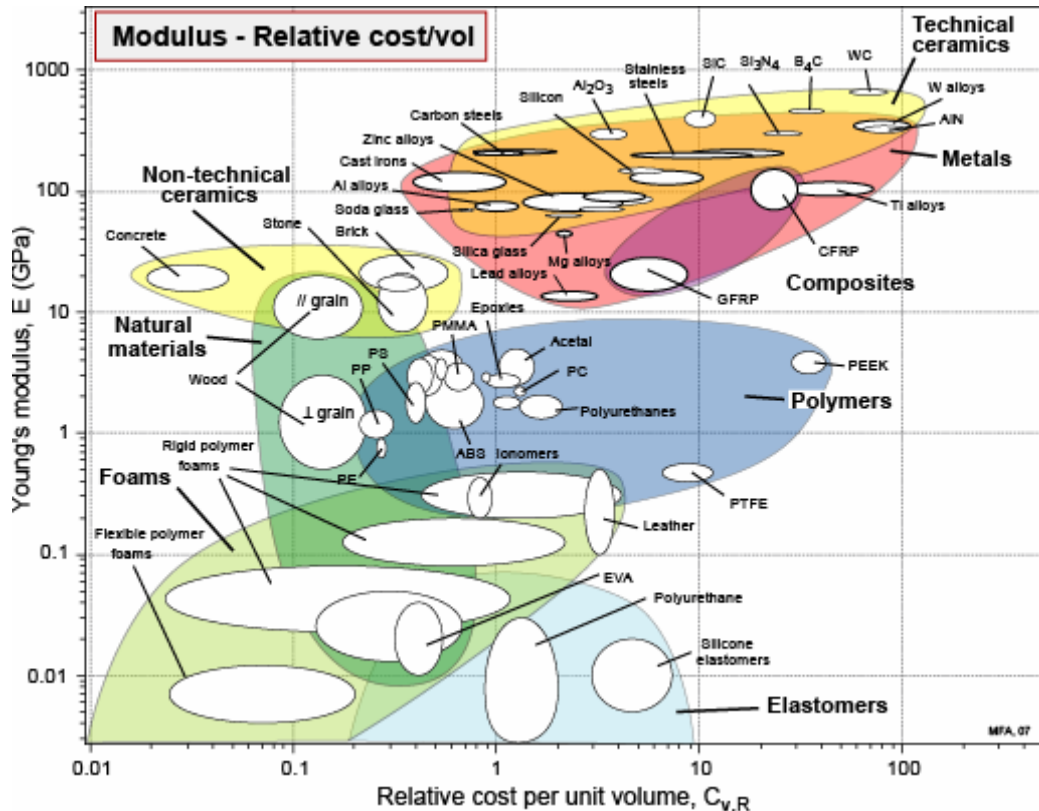


## SE104 Homework 8

1. We are choosing material to produce a low-cost round column. The column must support a 1-ton axial force without buckling. It must have be  $1 \pm 0.01$  m tall. (a) Write down an equation for the material cost of the column in terms of the cost per kg of the material ( $C_m$ ) and the material density  $\rho$ . (b) What can be the free variable(s) in this problem? Derive the material performance index; (c) Identify three best candidates of material (Use the bubble chart provided below). (d) If the column height does not matter while the cross-sectional diameter must be  $10 \pm 0.1$  cm, what would be the material performance index? (e) Identify three best candidates for (d).



2. Do an independent literature research. Describe the detailed procedures to measure and calculate (a) Vickers hardness number and (b) Brinell hardness number. (c) Explain what is the major difference between them. Clearly give the reference(s); Wikipedia is not allowed.

3. We are trying to force a hardened steel needle into a piece of relatively soft metal. When we apply a force of 9.9 lbs, the needle does not penetrate much into the metal; when the force increases to 10 lbs, the needle enters deep into the metal surface. The needle tip is rod-shaped, with a flat end; its cross-sectional diameter is 0.5 mm. What is the approximate yield strength of the metal?