

## Assessing Engineering Environments

There is no Golden Rule. Here is one checklist to suggest a systematic approach to selecting a material:

- ✓ Do special requirements point to a particular material class?
  - 1) Must our material be stable at high temperatures? We might consider ceramics.
  - 2) Must the product be lightweight? It might have to be a plastic.
  - 3) Must our part be able to withstand impact? Metals do the best.
  - 4) Will corrosive chemicals be encountered? Plastics do not rust.
  
- ✓ What are the static mechanical loads?
  - 1) Is sufficient stiffness a design concern? If so, then, we will have to look closely at the elastic modulus.
  - 2) How do we avoid plastic deformation in service? The yield stress and how processing can change yield stress will be critical.
  
- ✓ Are there repetitive loads? Is vibration expected?
  - 1) Can we improve stress concentration geometries?
  - 2) Will surface treatments improve the lifetime? This we can do with metals.
  
- ✓ Will there be extremes in time or temperature?
  - 1) Are impact loads and/or low temperatures a concern? The critical stress intensity factor is probably the most important handbook number.
  - 2) Must we design for very long service times and/or high temperatures? Then, we worry about the steady-state creep rate.
  
- ✓ Is environment a concern?
  - 1) Will reacting atmospheres be present? Oxidation and direct chemical attack will particularly be a concern with metals.
  - 2) Will liquids, even just water, be in contact with our part? Electrochemical attack of metals is pervasive.