Chart 16: Dry wear rate against maximum bearing pressure, P_{max}

The wear rate is defined as

$$W = \frac{\text{volume removed from contact surface}}{\text{distance slid}}$$

Archard's law, broadly describing wear rates at sliding velocities below 1 m/s, states that

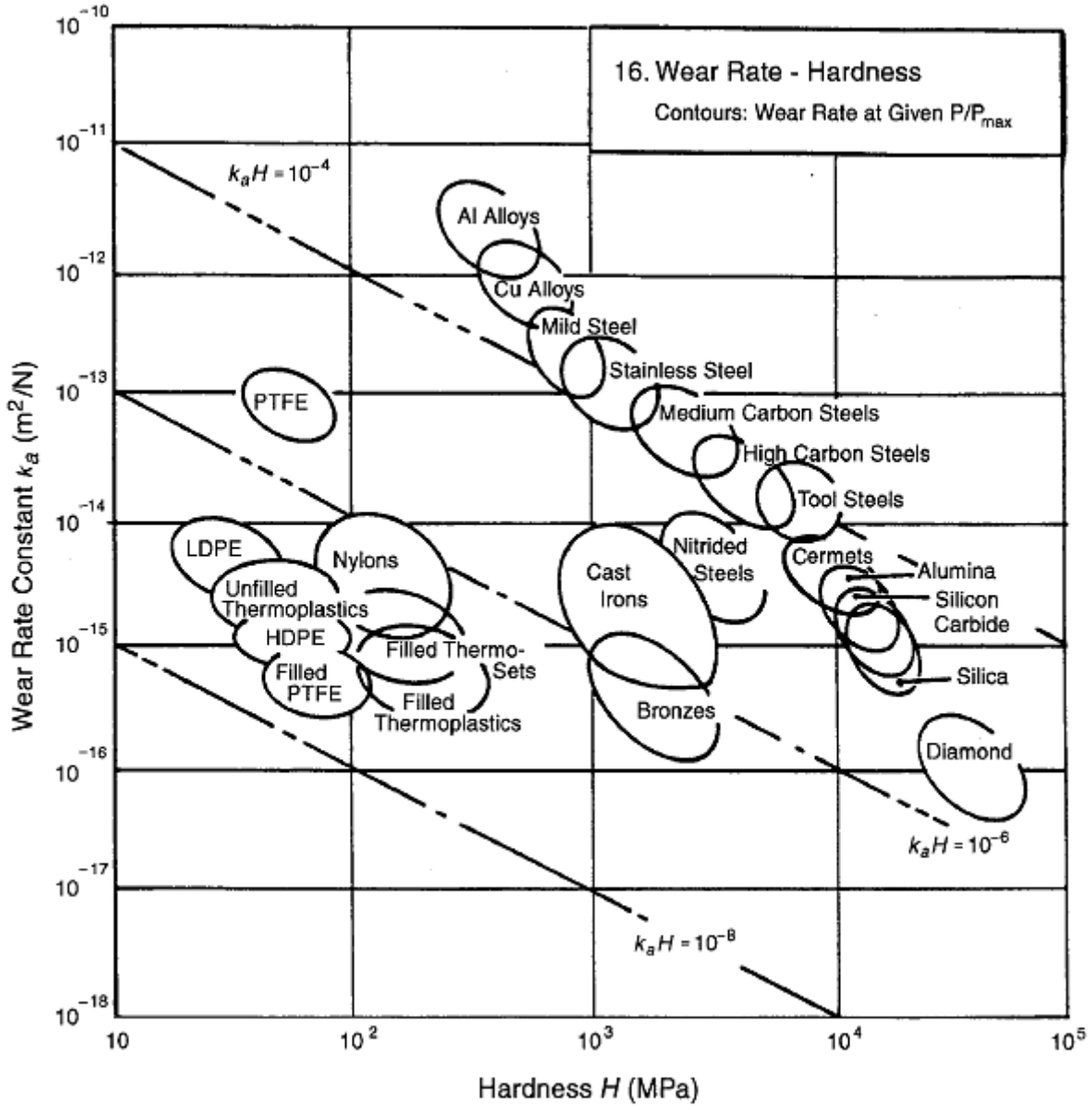
$$W = k_a A_n P$$

where A_n is the nominal contact area, P the bearing pressure (force per unit area) at the sliding surfaces and k_a is Archard's wear-rate constant. At low bearing pressures k_a is a true constant, but as the maximum bearing pressure is approached it rises steeply. The chart shows Archard's constant,

$$k_a = \frac{W}{A_n P}$$

plotted against the hardness H of the material. In any one class of materials, high hardness correlates with low k_a.

Materials which have low k_a have low wear rates at a given bearing pressure, P. Efficient bearings, in terms of size or weight, will be loaded to a safe fraction of their maximum bearing pressure, which is proportional to hardness. For these, materials with low values of the product $k_a H$ are best. The diagonal lines show values of $k_a H$.


16. Wear Rate - Hardness
Contours: Wear Rate at Given P/P$_{max}$
Wear Rate Constant k_a (m^2/N)
Hardness H (MPa)
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-17}
10^{-18}
10
10^2
10^3
10^4
10^5
$k_aH = 10^{-4}$
$k_aH = 10^{-6}$
$k_aH = 10^{-8}$
Al Alloys
Cu Alloys
Mild Steel
Stainless Steel
Medium Carbon Steels
High Carbon Steels
Tool Steels
PTFE
LDPE
Nylons
Unfilled Thermoplastics
HDPE
Filled PTFE
Filled Thermo-Sets
Filled Thermoplastics
Cast Irons
Nitrided Steels
Cermets
Alumina
Silicon Carbide
Silica
Bronzes
Diamond