Criterion and Geometry of Tool Wear

Tool wear progresses as a cutting operation progresses; the wear land extends from the cutting edge up the flank of the tool. In addition, a characteristic cavity, known as a "crater," forms at a certain distance from the cutting edge on the tool face as illustrated in Fig. 1–19.

The flank wear is described in Fig. 1–19 by the wear land, h_f, while the crater is indicated by width, l, depth, e, radius, R_c, and the distance from the cutting edge,

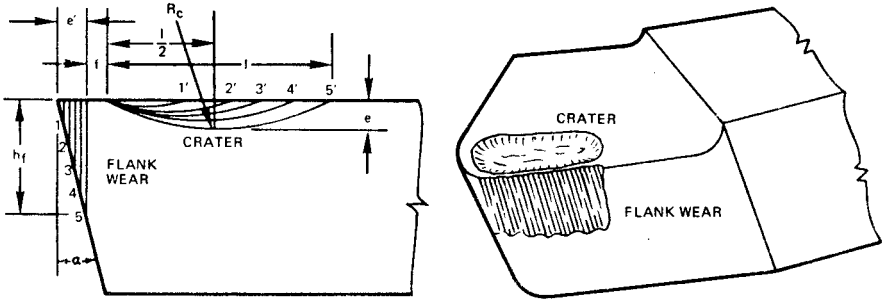

Fig. 1–19. Schematic views of flank wear and crater patterns.

f. An example of the growth rates of each element is shown in Fig. 1–20. After the initial wear, flank wear increases almost linearly at a uniform rate up to the point which leads to complete failure by means of rapid wear rate.

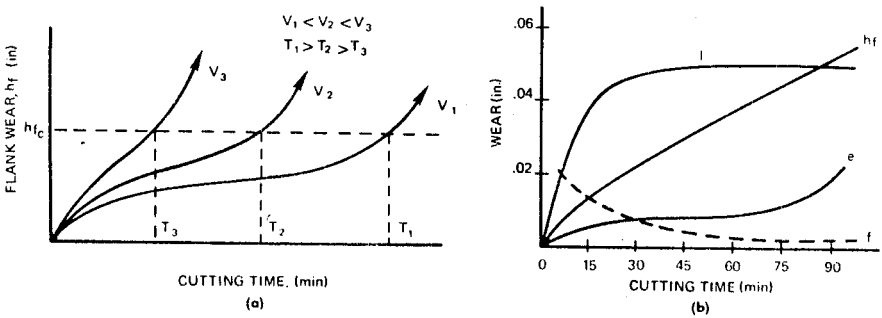

Fig. 1–20. Influence of cutting speed on flank wear (a), and wear rates of flank wear and cratering with respect to cutting time (b).

Because it is desirable to replace a tool before it fails completely or loses its originally intended tool profile, a quantitative value determining a limit of permissible tool wear (commonly known as the "wear criterion for tool life") is used in cutting operations.

The wear criterion varies with tool and workpiece materials and their combinations, and is chosen for flank wear, cratering, or both. The wear criterion for cratering, h_c, is given by:

$$h_c = \frac{e}{\frac{l}{2} + f} \qquad (1\text{–}57)$$

$$= .4 \text{ for carbide}$$

$$= .6 \text{ for HSS}$$

Where: e = Depth of crater wear

f = Distance of crater from cutting edge

A criterion for flank wear of .025 in. to .030 in. wearland length, h_f, is commonly used for carbide tools.