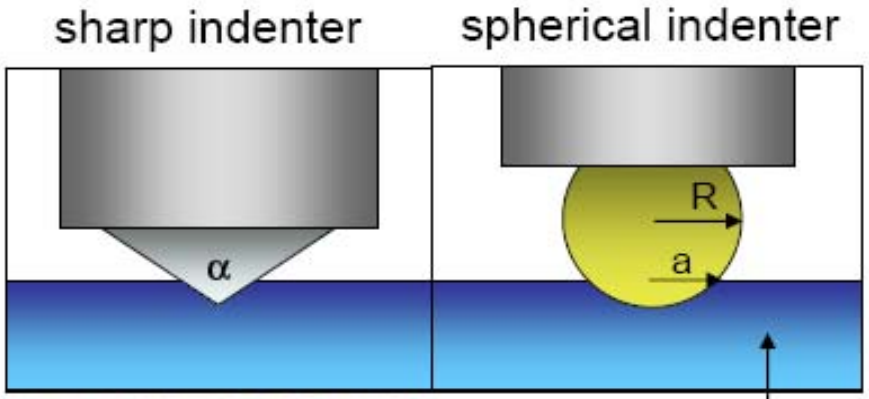
3.032 Mechanical Behavior of Materials

Fall 2007

Hardness testing: Estimates of yield strength

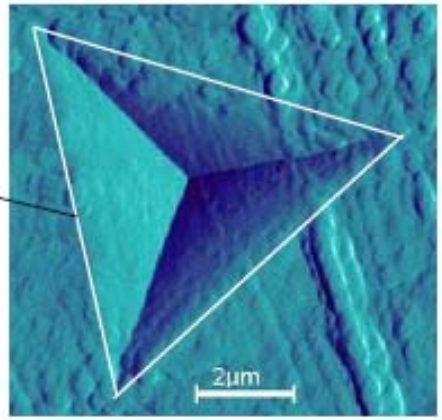
Hardness = H = Load/Area = $P / A_{c,\ projected}$



Sharp indenter names:
Brinell
Vickers
Berkovich
Knoop
Cube corner
Rockwell (some scales)

Spherical probe names:
Brinell
Rockwell (some scales)

$A = \pi a^2$



projected area of contact

$A = \beta d^2 \sim 25h^2$

Table removed due to copyright restrictions.
Please see http://en.wikipedia.org/wiki/Brinell_scale

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Instrumented Indentation: Estimates of elastic modulus and yield strength

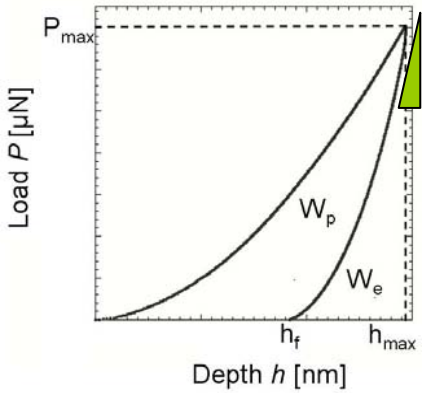
Images removed due to copyright restrictions.

Please see

Fig. 1 in Juliano, T. F., et al. “Multiscale Creep Compliance of Epoxy Networks at Elevated Temperatures.” Experimental Mechanics 47 (2007): 99-105.

Fig. 1b in Tweedie, Catherine A., and Van Vliet, Krystyn J. “On the indentation recovery and fleeting hardness of polymers.” Journal of Materials Research 21 (December 2006): 3029-3036.

Analysis



$$E_r = \beta \frac{dP/dh\big|_{P_{max}}}{(A_{max})^{1/2}} = \left[\frac{1-\upsilon_i^{\,2}}{E_i} + \frac{1-\upsilon_s^{\,2}}{E_s}\right]^{-1}$$