

3.40J / 22.71J
Modern Physical Metallurgy
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Lecture 11: Grain boundary effects

March 18, 2004

Grain boundary effects

International standards for grain size measurement:

ASTM E112

DIN 50601

JIS G-551

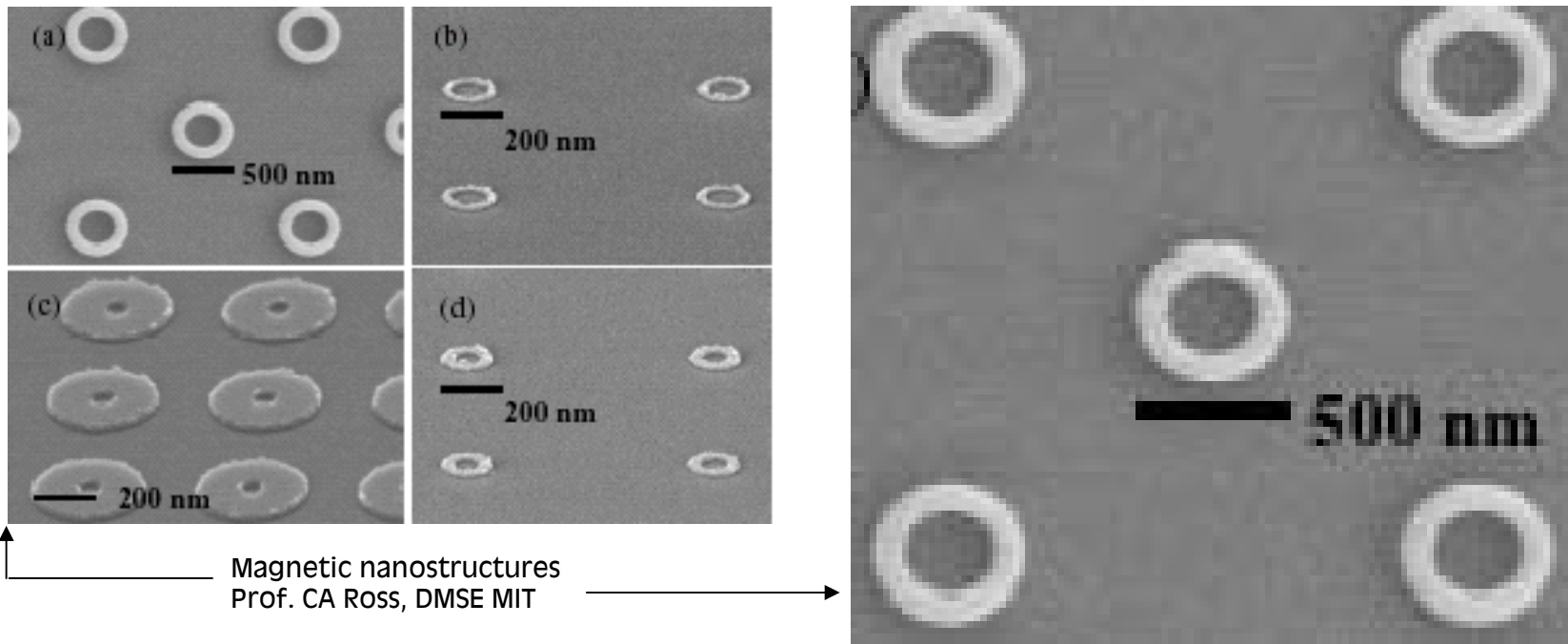
JIS G-552

Why is this characteristic of metals important enough to be standardized?

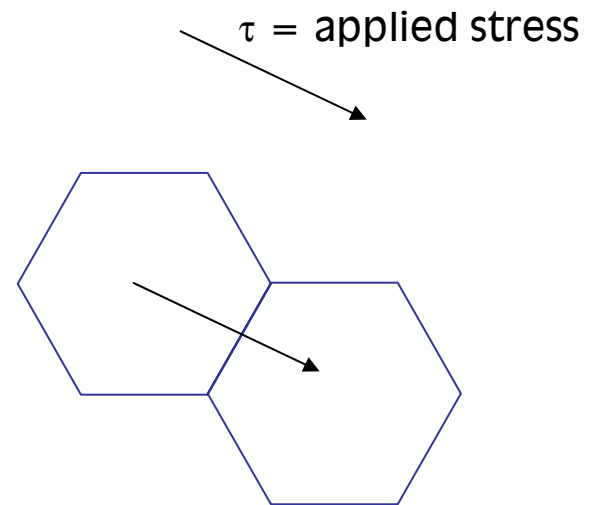
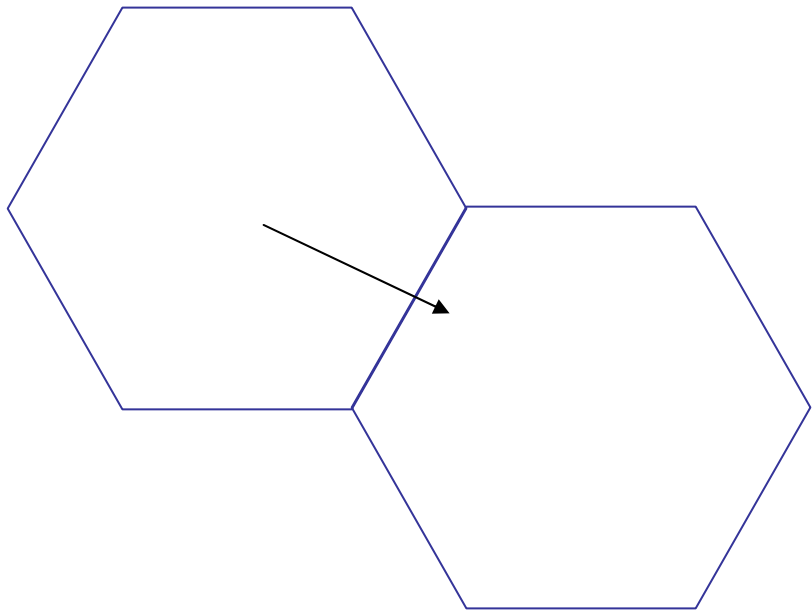
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Grain size & Magnetic effects

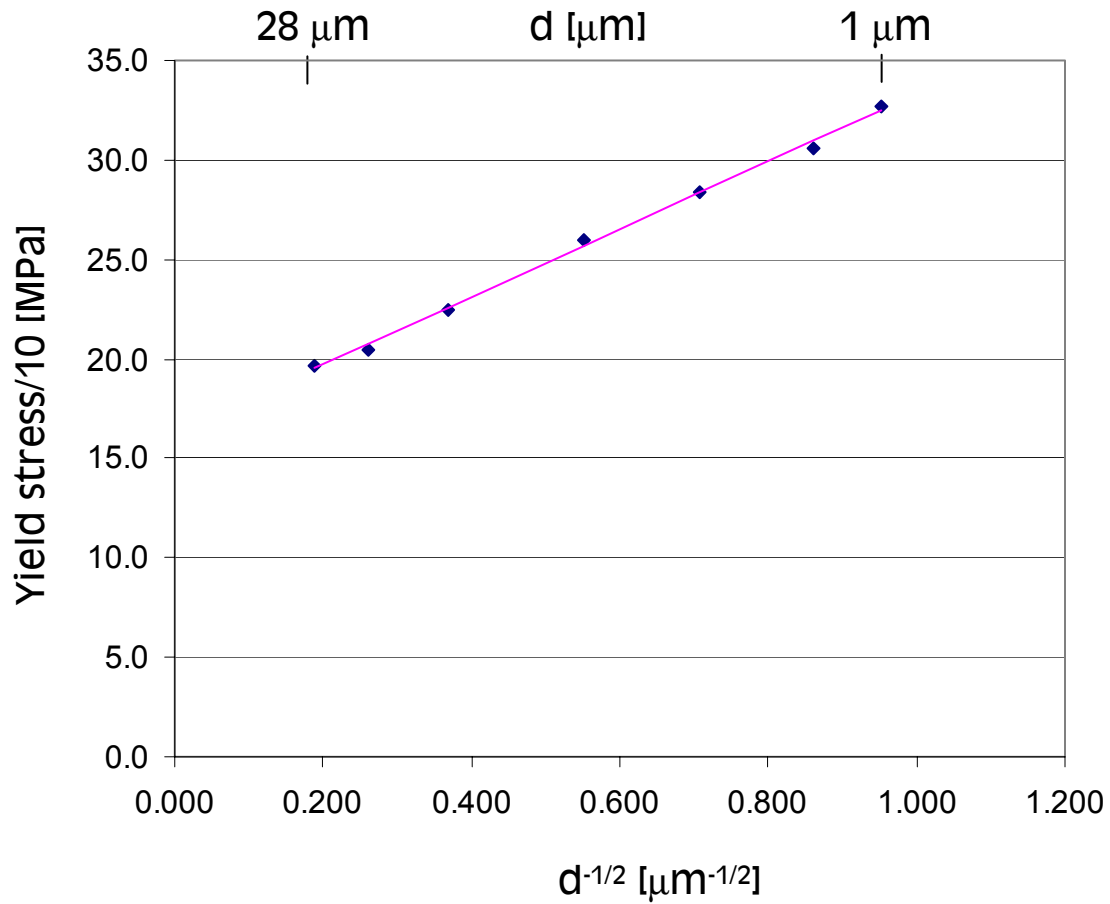
(Courtesy of Prof. Caroline Ross. Used with permission.)



Grain size & Mechanical effects



Grain size & Mechanical effects

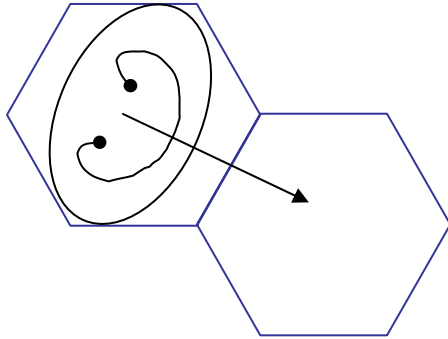


Experimental data
G.W. Brandie, 2003; Chemical Engineering, Queens College
Samples = steel

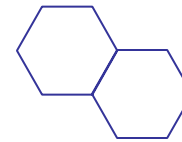
Grain size & Mechanical effects

- Hall-Petch relation: $\sigma_y = \sigma_0 + kd^{-1/2}$

(EO Hall, 1951; NJ Petch, 1953)



Microscale grains



Nanoscale grains
(too small for loops/sources)