0701A: Linear Shrinkage Strain to Volumetric Strain

1.

In class we have derived a relationship between the (relative) density and the linear strain given by Eq. 1 just below,

$$\varepsilon_a = 3\varepsilon$$

We measure the linear strain ε, and from that we wish to get a measure of the density.

$$\rho_g = \frac{M}{V_0}$$

$$\rho = \frac{M}{V}$$

$$\frac{\rho_g}{\rho} = \frac{V}{V_p}$$

$$\varepsilon_a = \ell n\left[\frac{V}{V_o}\right] = \ell n\frac{\rho_g}{\rho} = 3\varepsilon$$

$$\rho = \rho_g e^{-3\varepsilon} \qquad (1)$$

Make a plot of the linear strain that would spell full densification for different values of the green density, which range from 50% to 65%.

2.

Assume the structure of the particles (or grains) to be in the form of tightly packed cubes with one pore located at each corner, so that each pore is shared by eight cubes.

Assume the pores to be spherical in shape. If the green density of the structure is 50%, calculate the ratio of pore diameter to the edge length of the cubes.