Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

What is the Real Lewis Law? Size-Topology Correlations for Anisotropic Objects SANGWOO KIM, MUYUN CAI, SASCHA HILGENFELDT, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Ever since its empirical formulation in 1928, Lewis's law has intrigued scientists, postulating a linear correlation between the average in-plane area and the number of neighbors in a two-dimensional tiling. Many supporting and dissenting results have been reported in systems as diverse as foams, Voronoi tilings in glass models, and nanocrystals. A strong size-topology correlation is consistently observed, but it is often pronouncedly nonlinear. Recently, a variant of the granocentric model explained numerous cases of nonlinear correlations, but cannot account for the linear version of the law. We revisit Lewis's original work by conducting more extensive experiments on cucumber epidermis tissue. The data confirms the linear law, but also shows that the individual cells have a pronounced anisotropy, not present in systems with nonlinear correlation laws. We demonstrate how the granocentric model can be modified taking into account the cell anisotropy, and how this feature is capable of reproducing the linear Lewis law, as well as other characteristic differences in size-topology statistical quantities. The model should be generally applicable to jammed, plane-filling systems and identifies domain anisotropy as an important ingredient in their statistical description.

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Date submitted: 14 Nov 2013 Electronic form version 1.4