The Sidney E. Fuchs Seminar Series

3:00-4:00pm, Friday, March 24th, 2017
Frank H. Walk Design Presentation Room

Crystals Are Like People: Growth and Defects Are What Make Them Interesting

by Michael F. Doherty *

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Crystalline solids are ubiquitous in the manufacturing industries, in nature and in everyday life. In most cases the properties of the crystalline solid (e.g., crystal structure, shape, size, etc.) have a major impact on the functionality and value of the product as well as the design and operation of the manufacturing process; in most cases the two cannot considered separately. Gibbs was the first to recognize that crystals rarely achieved their equilibrium (surface energy minimizing) shape but it took almost 100 years to discover how to identify their real growth shapes. The key was to recognize that perfect crystals do not grow, thus growth at low supersaturation must be associated with surface defects. In this seminar I will describe a novel, (relatively) simple and accurate method for predicting the shape evolution and ultimate steady-state shape of 3-dimensional faceted crystals grown from solution. The model is initialized from an arbitrary initial seed shape and size, but known polymorph. The growth model for the crystal faces is based on the pioneering screw dislocation model of Burton, Cabrera and Frank in which surface integration kinetics is the rate determining step. The model has been successfully applied to a selection of real crystalline materials.

* Michael F. Doherty is Professor of Chemical Engineering and former Department Chair at the University of California Santa Barbara. He is a member of the National Academy of Engineering. He received his B.Sc. in Chemical Engineering from Imperial College, London in 1973, and his Ph.D. in Chemical Engineering from Trinity College, University of Cambridge in 1977. His research interests include process systems engineering with particular emphasis on crystal engineering, and separation with chemical reaction. He is the holder of five patents, has published over 200 technical papers and given over 250 invited lectures. He has received numerous honors and awards for his teaching and research, including the Alpha Chi Sigma Award for Chemical Engineering Research (2004) from the AIChE and the E. V. Murphree Award (2012) for Research in Industrial and Engineering Chemistry from the ACS. In 2008 he was named one of the "One Hundred Chemical Engineers of the Modern Era (post 1945) by the AIChE.