

# Chapter 1. Overview

Mathematical models are used for scale-up of novel chemistry recently invented in the laboratory to the manufacturing plants. Mathematical models can be developed in order to understand the science that drives the technology. Often time technological breakthroughs come about before good understanding of the scientific principles used. One example is the advances made in the field of nanoelectronics. Principles of nanoscience are being developed currently. The global consumer electronics industry has a growth rate of 7% each year from 2012-2015 and was \$965 billion in size in the year 2011. China's electronics industry is twice as large. Electronics is an important part of the manufacturing sector that includes cars, airplanes, chemicals, drugs, electronics and processed food. Leading companies in the field of electronics in this country, United States are Cisco systems, Texas Instruments, IBM, Intel, Hewlett Packard, Apple, Dell, Zenith, Advanced Micro Devices and Emerson radio. Leading products are networking technology, consumer electronics, communication technology, dsp, integrated circuits, digital light processing, semiconductor products. The recent launch of products such as Amazon's kindle, apple's i-series of phones, music players, computer pads has powered the boom in the electronics industry. Boom and bust cycles are things of the past. Silicon wafers, photomasks, photoresists, photoresist ancillaries, wet chemicals, gases, sputtering targets, chemical mechanical planarization slurries and pastes are the leading electronic materials on the market.

Nanoelectronics captures how semiconductor materials are evolving to enable successive generations of computer chips. The technology behind the computer chip revolution is discussed. How e-ink is used to bring color in the panel displays is elaborated. Examples are drawn from the success stories of mobile phones, laptop computers, internet, desktop computers, i-pads, medical instruments, automobile panel display, watches, personal digital assistant, TV sets, boom boxes and audio devices, airplane panels, control systems and sensors, robots. NEMS nano electromechanical systems, analog to digital conversion, data acquisition are discussed. The chip called atom with the size less than a penny has 42 nm features that Intel supplied to Nokia the mobile phone manufacturer.

Elements from half the periodic table are used to as materials to provide electrical functionality in semi-conductor materials. The materials explosion is discussed here.