

COMMERCIALIZING NANOTECHNOLOGY

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ABSTRACT

Zyvex was started in 1997 to develop molecular nanotechnology – the blend of nanoscience and nanoengineering required to do atomically precise manufacturing with commercial scale. This talk discusses how we are implementing a long term strategic plan with near term tactical milestones.

INTRODUCTION

Nanotechnology has come a long way in the seven years since the founding of Zyvex. As the market has developed in the last three years, Zyvex has transitioned from being research-intensive to being product focused. As one of the few nano companies with products, revenue, and well-recognized customers, Zyvex is steadily moving toward the profitability that will support its long-term vision of adaptable, affordable, molecularly precise manufacturing.

THE LONG-TERM STRATEGIC PLAN

Our original business plan was based on developing massively parallel, nanoengineered systems that can perform certain kinds of chemistry with positional control. Being able to build a large class of rigid, atomically precise structures will enable new kinds of materials, computers, and even medical devices.

Our strategy was, and still is, to work on the top down and bottom up simultaneously. The top down approach entails building small systems that can build smaller systems without direct human intervention, so that we can create massively parallel systems by iterating a simple design. The bottom up approach means designing a simple set of reactions that can be controlled with programmable positional probes to build very complex, but precise, molecular-scale objects. The two approaches meet when the bottom up process results in parts with sufficient functionality to use as components in the top down system architecture. At that point, the serial bottom up process can be parallelized with massive numbers of positional probes, since they are made from simple molecular building blocks and are made as cheaply as molecules.

THE TACTICAL PLAN

The long-term strategic plan will take at least 10 more years to achieve, so it is important to develop products that provide a revenue stream during this development. The accelerated pace of worldwide nanotechnology investment and increased interest in the field has accelerated Zyvex's plans.

An analysis of the potential markets for an early-stage nanotechnology company convinced us to start with tools for R&D, broaden into materials as that field develops, and in the long term, develop new structures uniquely enabled by our skill in nanoengineering. Figure 1 below shows our estimated market size and growth of these respective areas.

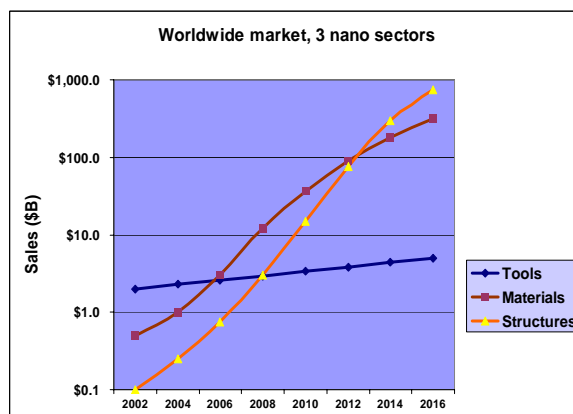


Figure 1: Est. market: tools, materials, structures

Current tools are nanomanipulators for research, nanoprobers for the IC industry, and a software tool for MEMS (silicon micromachine) design. Current materials use carbon nanotubes to improve material performance related to thermal capacity, electrical conductivity, and mechanical strength. Current structures are at the millimeter to micrometer scale, and include miniaturized instrumentation and assembly technology. Examples from each area will be shown.

We are targeting three major market segments with these products: aerospace and defense, computers and communications, and medical and health care.

NANOENGINEERING and NANOSCIENCE

The nanotechnology field should really be called nanoscience today, when one looks at where most of the R&D money is going. In order to turn it into true nanotechnology, we need to begin doing nanoengineering; that is, making objects with a defined purpose that solve a problem. Controlled self-assembly is one way to do this, but Zyvex believes positionally controlled nanomanipulation is key to achieving adaptable, affordable, molecularly precise manufacturing. Well-architected manipulation and assembly can span the scale from macroscopic to molecular.