

Project Title: ONAMI Low Cost Production of Nanoparticles

Project Funding: \$650,000 Keck Foundation

Project Description: Program Description:

This project involves the development of a microreactor production system to produce dendrimer molecules. Dendrimers have great potential for many uses. In the health care industry, they are used as contrasting agents for MRI imaging and as an aid in drug delivery. For environmental use, they can be used to purify water of toxins.

The current problem with dendrimers is the very high cost of production of these valuable nanoparticles. The molecules are extremely complex and fragile. Due to their complexity, hundreds of separate reactions must be done, usually in a laboratory conducted by chemists using beakers. In addition, because these are complex molecules, they are fragile and only about 3% of the original molecules survive the multitude of chemical reactions to take place. In essence, the end product is so expensive, it would be equivalent to cleaning toxins from water with gold!

In essence, the ONAMI team saw this problem of dendrimer production as a manufacturing problem with a large labor content with a very low yield of final product. The solution was to eliminate the labor intensive manual handling and to devise a device that would minimize damage to the product. In essence, microscale automation was employed to perform this task.

A microdevice that employed a series of convergent branches of different chemicals, with each junction causing a needed reaction provided the solution. Through the branching scheme of the microchannels, no human intervention is necessary. Because very minute amounts of chemicals are released through the microchannels at any one time, the process could be better controlled, thus yielding dendrimers with 99% intact. In summary, the project will provide a low cost dendrimer that will be far more competitive in the marketplace than current dendrimers.

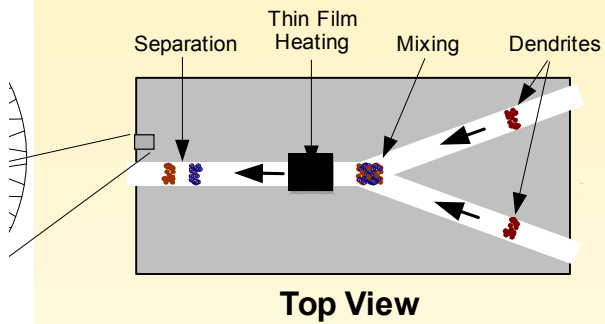
Student Involvement:

This project currently involves three graduate students for three years each.

Innovations, new companies and jobs: This is a new project and is only six months old with a three-year life span. The dendrimer market is estimated to be over \$2 billion annually if the product can be manufactured in a cost effective manner.

Graphics:

The "nanofactory" microsystem



Kearny 1997, Kniller et al. 1999, Penco 2000

