Carbon Nanotube Application
Application Test Data and Results

Application:

Carbon nanotubes possess extraordinary physical and mechanical properties for a wide range of applications from nano-electronics devices, ultrasensitive biosensors, protein immobilization, polymer composite engineering and drug/gene delivery systems. Individual CNTs are sized, configured and arranged to achieve structural optimization. Different kinds of CNTs are being researched on a daily basis to discover new applications and unique opportunities.

Objectives: To carefully and gently process CNTs in order to unnest or separate enmeshed CNT bundles without destroying fiber lengths.

Testing Procedures: CNTs combined with distilled water and surfactant, were blended gently with a high shear mixer before processing in the DeBee system. Multiple samples were tested under the following setups and conditions to determine the best results:

- Flow Patterns
  - SPF = Single Parallel Flow
  - SRF = Single Reverse Flow
  - DF = Dual Feed (1 Jet)
  - DJ = Dual Jet Flow (2 Jets)
  - DF/DJ = Dual Feed & Dual Jet
- Absorption Cell Patterns – Number and Size of Reactors
- Operating Pressure (psi) & Back Pressure (psi)
- Nozzles Sizes – Range from 0.1mm - 0.25mm
- Heating/Cooling Setups – Pre & Post Cooling

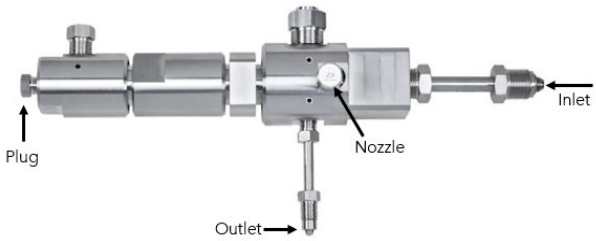

Figure 1: Patented Emulsifying Cell (EC)

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The Single Reverse Flow (SRF) EC configuration with one, 0.18mm and ten, 1.0mm ID ceramic reactors in the absorption cell, along with one, 0.18mm nozzle produced the best results for this CNT application.

Samples were processed with our proprietary pumping system under different operating pressures.

The best test results were generated with 35,000psi. The pre-mix CNT solution was loaded into the main processing reservoir for homogenization under high pressure. The sample entered the Emulsifying Cell through the inlet and flowed through a 0.18mm diamond nozzle. The SRF configuration utilizes one ultra-high velocity jet stream impacting at the end plug. The end plug reverses the flow and motion of the product back toward the entry point thus creating a high degree of product disruption. The fluid-against-fluid jet streams collided in the absorption cell creating optimal cavitation, impact and shear for particle size reduction. The processed product flowed through the outlet directly into the heat exchanger for product cooling. Final analysis and test results were verified by the customer under a microscope.

Goals and Successes:

- One pass homogenized product to nanometer particle sizes confirmed via microscope analysis
- Patented homogenizing cell technology provided optimal test results
- 35,000psi produced the desired results
- Perfect product suspension output was achieved
- Faster processing than ultrasonic technique
- Repeatable and consistent results
- Significant cost and time savings with laboratory, pilot, and production systems

Pion

Pion stands behind the science

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