Flow & Heat Transfer Apparatus

for POLY-Nanofluids

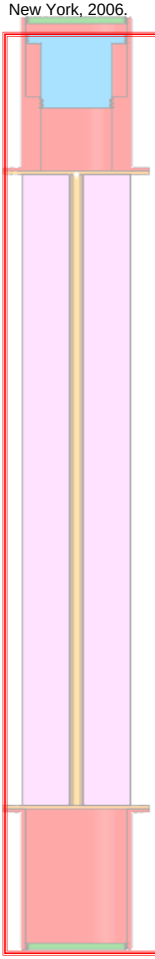
Preliminary Design

NORTHERN ILLINOIS UNIVERSITY

More at: www.kostic.niu.edu/DRnanofluids

Prof. Kostic has been awarded a NSF research grant
(CBET-0741078 Thermal Transport & Thermal Processing, 2007/2008):
Exploring New Hybrid Polymer-Nanofluids with Enhanced Flow and Heat Transfer Characteristics

- **Ben Nichols, "Investigation of *Flow and Heat Transfer Characteristics of Polymer-Nanofluids,"*** M.S. Thesis. Department of Mechanical Engineering, In progress, 2009.
- **Kostic, M and Simham, K.C., *Computerized, "Transient Hot-Wire Thermal Conductivity Apparatus for Nanofluids"***, In RECENT ADVANCES in HEAT and MASS TRANSFER (Editor: Lifeng Xi), ISBN: 978-960-474-039-0; ISSN: 1790-5095, p. 71-78, WSEAS Press. 2009. **Best HMT'09 Conference Paper**).
- **Kostic, M., "Critical Issues and Application Potentials in Nanofluids Research,"** ASME-MN2006 Multifunctional Nanocomposites 2006 International Conference, September 20-22, 2006, Honolulu, Hawaii, ASME Proceedings, New York, 2006.



Specifications

General

- **Transient, batch testing of laminar and turbulent, nanofluid flow and heat transfer**
- **Capable of testing Reynolds numbers up to 70,000**
- **Minimum test time, ~ 5 s**
- **Instrumented with Data Acquisition and Computerized**

Fluid Reservoir

- **Input pressure up to 1500 psi**
- **Testing fluid volume up to 1.0 L**

Flow Tube

- **Smooth 316 Stainless Steel, seamless tube**
- **0.085 in ID, 0.125 in OD**
- **High flow 316 S.S. Ball Valve**
- **Low DC voltage, high current internal heat generation**
- **Precise thermocouples along tube length for temperature readings**

Sample Test Parameters

for Re ~ 10,000

ΔP = 20 psi

V = 12 ft/s

Q= 300 Watts

ΔT = 5 °C

t =73 s

Relevant Equations

$$f = \left(\frac{2\Delta P}{\rho \cdot V^2} - \Sigma k_{loss} \right) \frac{d}{L}$$

$$Nu = \frac{h \cdot d}{k_{fl}} = \frac{\dot{Q}}{k_{fl} \pi L (T_w - T_{fl})}$$