



Team #13 Micro-Mixer Reactor

Parker Caronia, David Deville, Sarah Ellis, Daniel Gates

Sponsors: Dr. Nikitopoulos,
Chevron Corporation
Advisers: Dr. Daniel Park,
Nic Dinicola



Introduction

Project Objectives

- Viability of manufacturing microfluidic devices via 3D Printing
- Compare 3D Printing manufacturing to Replication Methods

Micro-Mixer Benefits

Small Footprint	Fast Mixing	Small Internal Volume
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Replication

Feature Size (+)
2.5D Limited (-)
Manufacturability (+)
Testing Procedure (+)

3D Printing

Feature Size (-)
3D Capable (+)
Manufacturability (-)
Testing Procedure (-)

Design Process

Engineering Specifications

Mix Quality	Pressure Drop	Production Rate	Burst Strength
95% (▼)	2 Atm (▲)	26.1 mL/min (□)	15 bar (▼)

▲ = Maximum; ▼ = Minimum; □ = Target

3D Design Features

Stacked Channels
Fluid Layering
Diffusion Based Mixing
Low Reynolds #

Replication Design Features

Inverting Channels
Fluid Layering
Diffusion Based Mixing

Testing & Validation and Safety

Qualitative Data Acquisition

Flow Rate (✓)	Pressure (●)	Mix Quality (●)
26 mL/min	< 3 psi	96%

✓ = Control; ● = Dependant

3D Printer Precision and Accuracy

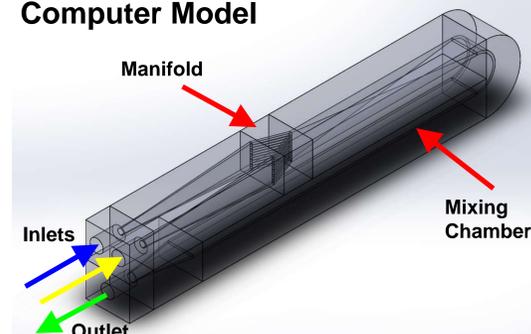
	Concept Laser	Objet 260	FormLabs 2
Bias Error	15 μm	100 μm	100 μm
Precision	+/- 25 μm	+/- 97 μm	+/- 17 μm

Safety Considerations

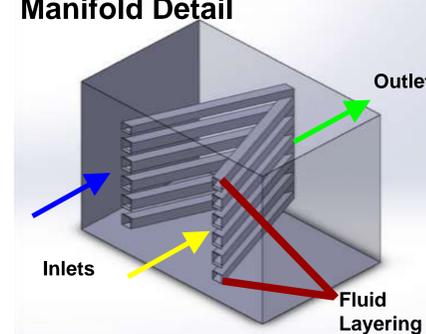
Component Factor of Safety = 3	Non-Toxic Testing Chemicals
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3D Printing: Diffusion Layer Mixer

Computer Model



Manifold Detail

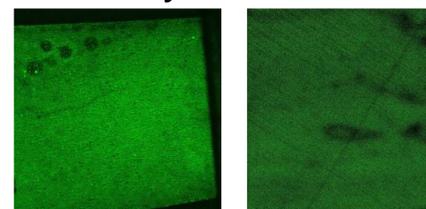


Fluid Layering



Fluid Layering #1 Fluid Layering #2

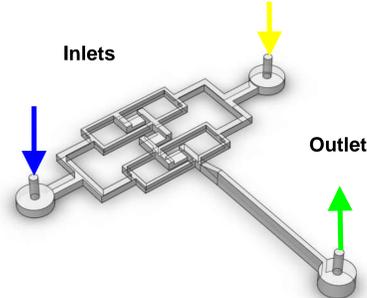
Mix Quality Test



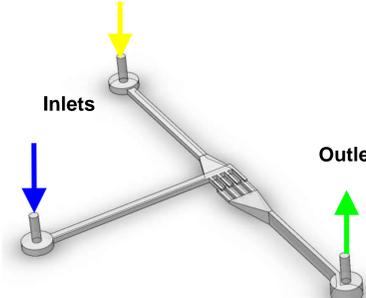
Inlet Dye Solution Fully Mixed Dye Solution

Replication Designs:

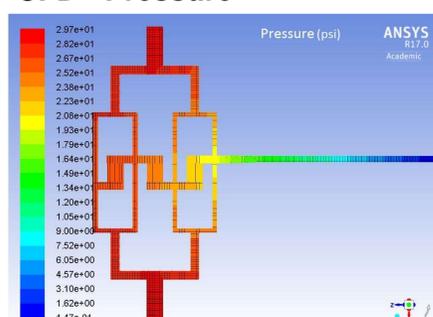
Wave Mixer



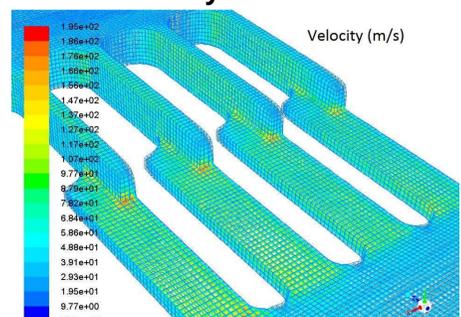
Waterfall Mixer



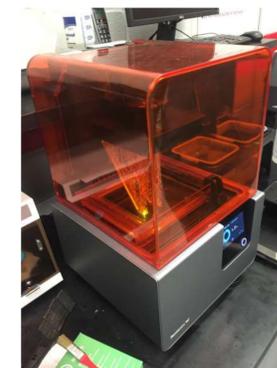
CFD - Pressure



CFD - Velocity



Manufacturing



1. Print Device - Formlabs



2. Clear Support Material



3. Post Process using Sterilizer

Budget and Timeline

