AN INVESTIGATION OF THE IMPORTANT PARAMETERS FOR MICRO-MIXING IN A SINTERED POROUS MEDIUM

Justin Stevens, USA
Supervisors: Prof. M.L. Riethmuller, Ph. Planquart, M.R. Vetrano
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Micro-mixers are defined as mixing devices in which the flow paths range from 1mm to 1µm. Several physical mechanisms for micro-mixing have been identified for passive mixers (those without an external energy input), the most popular recent principle being "mixing by chaotic advection", which can either be achieved by having a pulsatile flow or a chaotic/complex geometry.

Baxter Healthcare has requested that the important parameters with regard to mixing be identified for such a micro-mixer, a sintered porous media called "Vyon F". The device is currently being used to mix two bio-chemically reactive non-Newtonian fluids at low Reynolds numbers. Preliminary work done by Baxter has been done to characterize the geometry of the sintered discs of interest. This includes some pore size distribution work done by SEM as well as a pressure based method that yields pore size distribution. The porous medium has also been analyzed by micro CT scanner to allow an in depth observation of the geometry of the medium.

From this geometry realization, an 11.5:1 scale model was built via stereolithography and a parametric study was conducted in which mixing of two fluids was characterized in the porous mixing disc. A 0.1Pa·s Rhodamine-B dyed glycerol-water solution is injected into a geometry representative of the one used with the scale 1:1 mixing disc, a laser was used to illuminate a lateral observation section of the tube after the mixing device and grey scale images of the fluorescent dye were captured. The grayscale intensity is related to the presence of the dyed fluid across the diameter of the tube and is used as an indication of mixing quality. Three increased scale models were tested in all, two observing lateral sections of the diameter and one model in which the observation of a circular cross section of the tube is made possible by placing the camera above the model.