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Some turbulent like flow property observed in microfluidics G. WANG, F. YANG, W. ZHAO, University of South Carolina — We report some flow properties that are similar to what normally observed in many conventional turbulent flows, can also be achieved in an electrokinetic flow in microfluidics where the Reynolds number (Re) is in the order of 0.1. One important issue in microfluidic devices is the relatively slow mixing due to laminar flow at low Reynolds number. In conventional fluid dynamics, mixing can be enhanced by manipulate flow into turbulent flow. However, in mirofluidics, where Re is usually < 1, it is always believe that the flow is laminar. When mixing is enhanced (e.g. using AC electrical excitation) in microfluidics, it is believed that the flow is chaotic, not turbulence. If there is turbulence in microfluidics, another challenge is how to measure it. Here AC electrokinetics is used to excite a pressure driven flow in a microchannel with conductive sidewall to generate turbulent like flow at Re in the order of 0.1. First the flow is found to be random. With a recently developed laser induced fluorescence photobleaching anemometer (LIFPA) having high temporal and spatial resolution, we observe quantitatively random fluctuation of flow velocity and concentration in the flow. The scalar mixing is so rapid that the flow exhibits diffusion property in conventional turbulent flows. Visualization indicate that the flow may not be cahotic. Furthermore, we also observe that the power spectra of velocity and concentration exhibited a continuous decay with a span of more than one decade, again, indicating a multiscale property of turbulent flow.

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