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Turbulent mixing in microfluidics with Reynolds number in the order of 1 FANG YANG, WEI ZHAO, GUIREN WANG, University of South Carolina — One important issue in microfluidic devices is the relatively slow mixing due to laminar flow at low Reynolds number (Re). In many cases, fast mixing is highly demanded. In macroscale, where Re is relatively high, mixing can be enhanced by forcing flow to be turbulent. However, although there can be elastic turbulence in low Re, it is conventionally believed that the flow in mirofluidics, where typical Re is in the order of 1 or less, can only be laminar. In present work, we demonstrate that turbulent mixing can be realized in a microchannel, where the Reynolds number is in the order of 1 when the flow is forced electrokinetically. The turbulent mixing in microfluidics can cause ultrafast scalar mixing. Confocal microscopic laser induced fluorescence with high tempo-spatial resolution is used to study the turbulent mixing in the microchannel. We report the fast mixing process, concentration profile, irregular concentration time trace, segregation intensity and continuous power spectrum of concentration fluctuation indicating multiscale structures of small eddies. The results indicate that turbulent mixing can be realized as well in microfluidics with Re in the order of 1. The study could open a new perspective view on transport phenomena in microfluidics.

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