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Quantifying the dynamics of transitional clay flows within nearly isotropic turbulence SHAELYNN KAUFMAN, VAIBHAV TIPNIS, JIM BEST, LEONARDO CHAMORRO, SHYUAN CHENG, SAMYA SEN, RANDY EWOLDT, University of Illinois at Urbana-Champaign — Water-clay flows are found extensively across Earth's surface in a number of natural and man-made environments. Although progress has been made in the last two decades to characterize their fluid dynamics, the fine-scale fluid mechanics of transitional clay flows (volumetric clay concentrations of $0.01<C<0.8$) remain poorly understood. This is partially due to the challenges associated with imaging opaque flows. To address this problem, we have developed a novel approach that uses Laponite RD^{TM}, a synthetic clay capable of producing clear suspensions of clay particles within water, and thus enabling optical quantification of the flow in both Lagrangian and Eulerian frames of reference. In the mixing box, turbulence is generated by a series of eight symmetrical mechanical fans that are capable of generating nearly isotropic turbulence. Time-resolved particle image velocimetry is used to quantify the spatio-temporal dynamics of the flows, their spectral composition, statistics, and energy budget. This paper will provide details of the technique, and results of the experiments performed that show that a correlation exists between the Taylor microscale Reynolds number and Kolmogorov scaling of the temporal spectra as clay concentration increases above $C\geq0.015$, due to turbulence modulation caused by the presence of clay particles.

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