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Turbulence Modification by Solid Particles Measured by a High Resolution Particle Image Velocimetry.[1] TOMOHIKO TANAKA, JOHN EATON, Stanford University — Previous studies show that fine solid particles can strongly attenuate the turbulence of a gaseous flow, but the mechanisms of the reduction in turbulence kinetic energy (TKE) are not understood. Obviously, high TKE dissipation rates caused by a high strain around particles must play a role. In order to accurately measure the high dissipation rate surrounding particles, spatial resolution smaller than the particle size is necessary. Since most of the particle-laden research did not achieve such resolution, we believe that the TKE dissipation rate has been underestimated on the whole. The goal of the present research is to accurately estimate the distribution of TKE dissipation rate in a particle-laden air flow using a high resolution PIV system whose vector spacing (70 μm) is about half of the Kolmogorov length scale. The experiments are conducted in a homogeneous-isotropic turbulence chamber with a set of eight synthetic jets. The Reynolds number based on Taylor micro scale is approximately 200. The particles are 250 μm polystyrene spheres at a mass loading ratio around 20%. The TKE dissipation rate increases in the presence of particles, which is opposite of the previous findings. This results from strong shear strains in the vicinity of each particle, producing local regions of very high dissipation rate.

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