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Particle Relaxation Time for Titanium Dioxide in Hypersonic Flow[1] JOSE RODRIGUEZ, University of Illinois at Urbana-Champaign, BRIAN RICE, CHRISTOPHER MCKENNA, Air Force Research Laboratory — A critical component of the experimental technique Particle Image Velocimetry (PIV) is the response time of the seeding particles. Shock waves are commonly found in high-speed flow regimes, resulting in velocity discontinuities between pre- and post-shock regions. Seeding particles experience a time delay in the normal component of velocity as they transit the shock wave, known as particle relaxation time (PRT) Ragni et. al (J Exp. Fluids, 2011). This delay is a function of the diameter and density of the particle and the surrounding fluid's viscosity. These properties influence the particles' light-scattering ability and Stokes number (a ratio between the particle and fluid time scales) Melling et. al (J Meas. Sci. Tech, 1997). These properties contribute to imaging quality and how accurately the particles trace the flow. The PRT for TiO2 across an oblique shock was characterized via 2D PIV conducted in the von Karman Gas Dynamics Facility Tunnel D at Arnold Air Force Base. A 6.5 degree wedge was used to generate the oblique shock wave in a Mach 5 freestream. The PIV data was fit to exponential Stokes drag decay to obtain the PRT. These findings will be compared with results for other particles that are currently being used throughout the community.

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