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Quantum Nanospheres^{TM} for sub-Micron Particle Image Velocimetry CARL MEINHART, UC - Santa Barbara, PATRICK FREUDENTHAL, Nanex, LLC — Quantum Nanospheres (QNs) have been developed as a new type of flow-tracing particle for micron resolution Particle Image Velocimetry (micro-PIV). A 60 nm diameter QN is formed by conjugating approximately eighty 10 nm quantum dots (QDs) to an individual 43 nm polystyrene bead. Since QDs have relatively high quantum efficiency, the QNs are significantly brighter than commercially-available fluorescently-dyed particles of similar size. In addition, the 60 nm dia. QNs allow accurate velocity measurements close to microchannel walls and high spatial resolution for micro-PIV measurements. QNs maintain their fluorescent properties whether suspended in liquid or gas and may prove well-suited for gas-phase PIV. The use of QNs as flow-tracing particles for micro-PIV was demonstrated by measuring fluid motion in a 30 x 300 um channel. Using an interrogation region of 1 x 1024 pixels and ensemble averaging 1800 image pairs, we achieved a spatial resolution of 117 nm x 11.7 um x 2 um. Using 50% overlap between interrogation regions, the velocity vector spacing is 58.6 nm. Since the QNs have a nominal diameter of 60 nm, the particle diameter is 50% of the smallest dimension of the interrogation region. To the best of the authors' knowledge, these velocity measurements are the highest spatial resolution measurements (based on interrogation volume) reported to date.

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