High purity and precisely mixed liquid solutions are important to a variety of industrial processes, but sensors for such solutions often have significant drawbacks such as the need for regular calibration and the inability to continuously make real-time measurements. For some specialty liquids, such as cryogenic liquids or caustic solutions used in the semiconductor industry, direct sensors for composition and contamination don’t exist at all, and indirect methods must be used instead.

Fiber-loop cavity ring-down spectroscopy (FL-CRDS) can provide an ideal solution for many challenging applications. Since fibers are resistant to chemicals and extreme temperatures, a sensor based on FL-CRDS can be used in environments where other techniques and sensors can’t work.

In a FL-CRDS instrument, a laser is coupled into a loop of fiber, and a small amount of light is extracted from the loop to a detector with each pass. Spliced into the loop is a sensing element that allows the evanescent field of the light otherwise confined within the fiber core to interact with the surrounding environment. Results will be presented for detection of contaminants in liquids with several types of sensing elements: fiber tapers, side-polished fibers, and core-only fibers; each with a variety of geometries. Sampling systems for both continuous flow of small samples and for monitoring of static sample baths will also be presented.