Final ID: AG-08

High throughput Salmonella detection with Tunnel Magnetoresistance sensors

M. A. Torija; [1]; *L. Maldonado-Camargo;* [2]; *C. Rinaldi;* [3]; *S. Sreevatsan;* [4]; *M. Tondra;* [5]; *P. Mueller;* [1];
1. Ad tech, NVE Corporation, Eden Prairie, MN, United States.
2. University of Florida, Gainsville, FL, United States.
3. University of Florida, Gainsville, FL, United States.
4. University of Minnesota, St. Paul, MN, United States.
5. Diagnostic Biosensors, St. Paul, MN, United States.

Abstract Body: NVE in collaboration with the University of Minnesota, University of Florida and Diagnostic Biosensors have designed high throughput, high sensitivity salmonella detector, pivoting past biosensors. In the past, NVE's team has combined magnetic nanoparticles functionalized with aptamers and microfluidics to detect salmonella. The new prototype seeks the same objective with the added advantage that it will be able to measure more than 1 l per minute of sample.

The high-throughput pathogen detector is based on spintronic Tunneling Magnetoresistance (TMR) next to a through-hole that would carry the sample. Key features to increase sensitivity include a narrow distance between the flow-hole and the TMR sensor, an active and reference sensor elements forming a Wheatstone bridge and flux concentrators. A wide-field view in (a) shows the repeatable geometries of the devices in the array and the through-holes which are shown in cross-section in (b). The through-holes were photo defined, and etching with deep trench. A PDMS microfluidic inlet covered the sensor to perform the tests.

Prototype sensors were tested for magnetic sensitivity during flow using a sequence of alternating concentrations of water and nanoparticle solutions in flow. The standard procedure was to register the change in the bridge output from saturation to a minimum at low field while passing the sample. The measurements, summarized in Fig. 2, were normalized for each sensor. The sensor proved to have similar sensitivity to precious designs with the better advantages of a high hroughput capabilities and easy fabrication process.

This work was funded by USDA- NIFA SBIR 2015-33610-23593

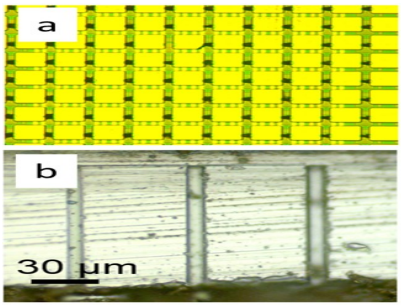

Figure 1. Wide-field images of the sensors. The holes are 10 µm diameter in (a). Cross-section of the through holes is shown in (b).

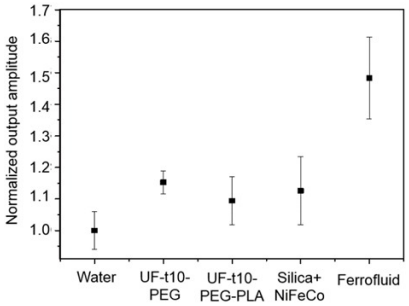

Figure 2. Normalized sensor amplitude output with water control and four different sample fluids: University of Florida iron oxide particles, NiFeCo coated silica particles, and APG312 3000 ferrofluid.