

NASA SBIR/STTR Technologies

T3.02 9983: **On-chip Nano-Plasmonics-Based Urine Protein Assay Cartridge**

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Identification and Significance of Innovation

- Rapid monitoring and assessment of astronaut basic health, in particular urinalysis or blood analysis, is a challenging problem
- Ground-based devices are bulky and less amenable to space operation
- Need leveraged and synergized harnessing of technological advancements in novel optics, microfluidics and lab-on-chip assay to engineer a solution

Technical Objective

Develop microfluidics-based automated method for quantitative urine protein detection

- Sample of microliter (urine)
- On-chip sample preparation and pretreatment
- Real-time analysis

On-Chip nanostructured plasmonics based assay for health monitoring

- A transmission-mode SPR sensing with enhanced sensitivity
- Waveguided modes enabled by metal nanoslits
- Robust sensing mechanism and design under microgravity
- Compatible to miniaturization, integration and instrumentation.

Phase I Accomplishments & Phase II Work Plan

Phase I Accomplishments_TRL 3

- Designed, fabricated and developed nanolist structured T-SPR sensor
- Designed, fabricated and validated of microfluidic components for sample pretreatment and liquid handling
- Demonstrated tailored receptors and protein detection

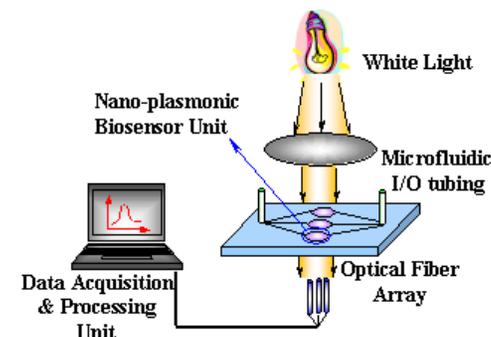
Phase II Plan

- Further optimization of urine protein assay cartridge
- Sensor regeneration for reuse
- Alleviation of nonspecific protein binding in chip
- On-chip integration of assay modules
- Biocompatibility testing and bubble mitigation
- System integration and prototype testing
- Correlation with ground-measurements

Concept of Product and Work Principle



On-chip Nanoplasmonic PAC Product Concept



Work Principle

NASA Applications

- Monitor astronaut health and develop preventive countermeasures against adverse health effects in space environment
- Investigate the effects of microgravity- and radiation on astronaut health and related syndrome at the protein level
- Pharmacotherapy environment monitoring in space mission
- Space biology experiments

Non-NASA Applications

- Health care and diagnosis
- Point-of-care diagnostics
- Biomedical/Healthcare R&D
- Preclinical and Clinical Research

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