Proceedings of SPIE 12860: Quantification of viral particles using a photonic crystal biosensor, San Francisco, United States, January 2024

Quantification of viral particles using a photonic crystal biosensor

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Abstract

The quantification of human immunodeficiency virus at point of care remains a challenge in resource limited settings. The incorporation of nanotechnology and label free optical biosensing has unlocked promising opportunities in the development of diagnostic tools for infectious diseases. Optical biosensors offer a rapid and sensitive optical method for various biological materials such as cells, biomolecules, and viruses by monitoring the dielectric permittivity changes at the interface of a transducer substrate and the analyte. This work focuses on exploring photonic crystal biosensor efficiency and sensitivity for viral load measurement. Photonic crystal biosensors are a unique class of biosensors that allow for label free analysis as they can control and confine light propagation due to the photonic bandgap. Silane treated photonic crystal was functionalized with anti-HIV-gp120 antibody before the addition of various concentrations of HIV pseudovirus. The samples were analyzed on a custom build transmission spectroscopy that used white light as a light source. The results showed a red shift at different virus concentrations, which demonstrates that photonic crystal biosensors are sensitive enough to detect differences in virus concentrations. Therefore, photonic crystals have a potential in the development of photonic crystal-based biosensors for viral load detection.