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Inductively coupled plasma mass spectrometry of photocorroding GaAs/AlGaAs nano-heterostructures in aqueous environments

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Photonic biosensors based on photocorrosion of GaAs/AlGaAs nano-heterostructures have been investigated as an attractive platform for low-cost and rapid detection of bacteria in aqueous environments.1, 2 Both GaAs and Al0.35Ga0.65As layers are unstable in an aqueous surrounding when illuminated with photons of energy exceeding bandgap of either of these materials. Among elements released to a biochip-containing cell, arsenic is of particular importance as the presence of this element could affect metabolism of some bacteria. 3, 4
To investigate the rate of photocorrosion, we have employed an inductively coupled plasma mass spectrometry (ICP-MS) technique. For this purpose, a series of samples were prepared with small volumes of the product of photocorrosion collected from GaAs/Al0.35Ga0.65As nanoheterostructures photocorroding for the same periods of time, for up to 14 hours. The nanoheterostructures were excited with an LED light source operating at 660 nm wavelength and delivering ~ 20 mW/cm2 of uniform radiation on the surface of investigated samples. For comparison, a series of liquid samples were also analysed for GaAs/Al0.35Ga0.65As nanoheterostructures kept under dark conditions. The results indicate that the maximum amount of As released during biosensing photocorrosion is less than 20 ppb. We discuss dynamics of the photocorrosion process and the influence of the products of photocorrosion on the performance of GaAs/Al0.35Ga0.65As biosensing devices.

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