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# Could GaAs (001) Know What Bacterium Has Bitten It?

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The etching of compound semiconductors with atomic level resolution is of high interest to technologies addressing the fabrication of low-dimensional devices, the tunability of their optoelectronic properties and the precise control of device surface structure. We have developed an innovative method of digital photocorrosion (DIP) for shallow (< 200 nm) etching of GaAs/AlGaAs nanoheterostructures with sub-monolayer resolution [1]. The rate and stability of DIP depend on the energy and intensity of photons employed for optical excitation, as well as on the chemistry of a liquid environment surrounding processed samples [2]. The excitation of electron-hole pairs allows for convenient application of the photoluminescence (PL) effect for monitoring in situ the DIP process, however similar diagnostics is also available for materials with negligible PL [3]. It is not surprising that the extremely low rate of etching of the investigated GaAs/AlGaAs nanoheterostructures is sensitive to the perturbation induced by electrically charged molecules immobilized in the vicinity of their digitally photocorroding surface. We have taken advantage of this effect in order to develop a DIP-based biosensor of viruses and bacteria [4]. I will discuss some of the fundamental parameters describing DIP and the technology of functionalization of a GaAs surface with antibodies against Escherichia coli and Legionella pneumophila bacteria. In the process of developing a semi-autonomous workstation for monitoring water reservoirs for the presence of E. coli and L. pneumophila, we also demonstrate specific detection of these bacteria in an aqueous environment at better than 103 CFU/mL.

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[3] S. Aithal, J.J. Dubowski, Open circuit potential monitored⋯, Appl Phys Lett, 112 (2018) 153102.
[4] J.J. Dubowski et al., Photo-electrochemical sensing method⋯, Patent, US 10,001,480 B2 (2018).

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