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ABSTRACT

Using specific peptide bacteria affinity, a monolayer of 30 nm Au particle is selectively deposited on live bacteria surface to produce electrically conducting bridges spanning over 12 *μ*m. The conductivity of the monolayer network is further improved by over 10-fold by "electric-field annealing". The annealing process is explained by a percolation model.

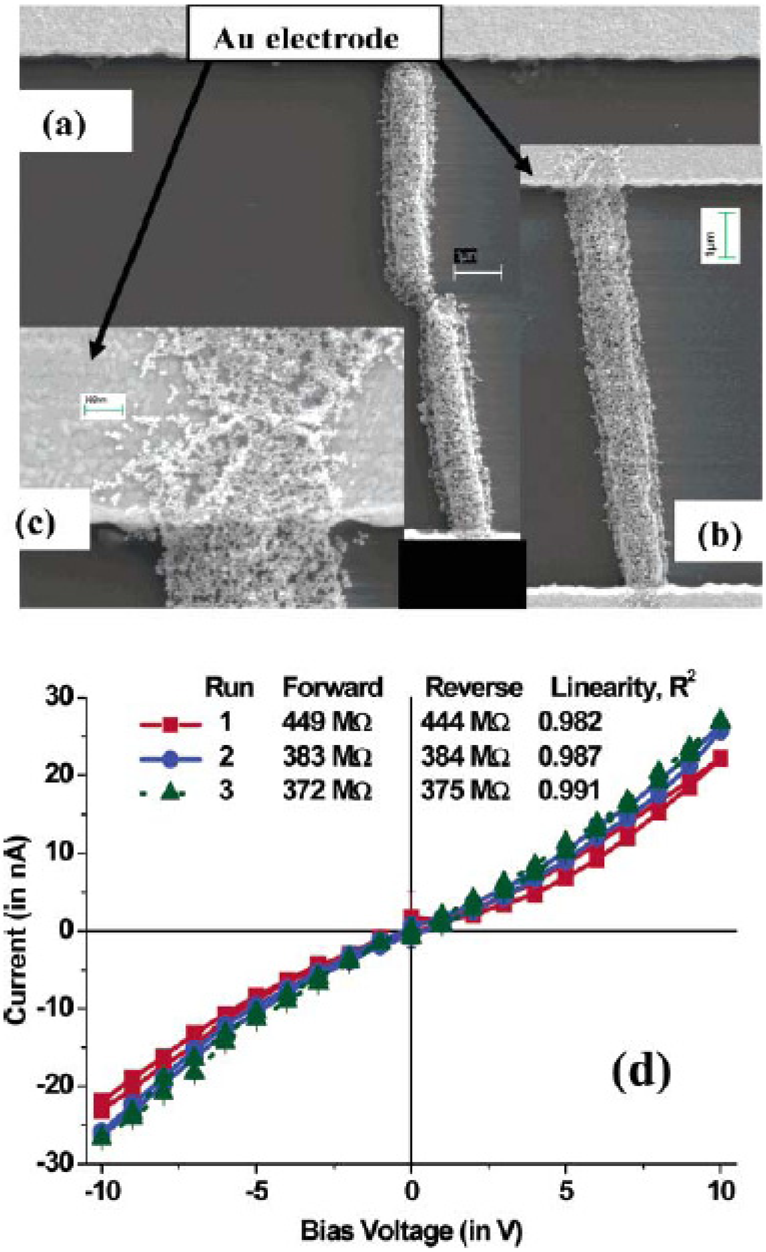

Figure 1. (a), (b) Typical FESEM images showing bacteria coated with Au nanoparticle monolayers and spanning between two Au electrodes at the extreme ends. The size bar is 1μm. (c) The nanoparticle size and monolayer morphology are more evident at higher magnification. The size marker is 300 nm. (d) Typical $I-V$ characteristics of as-received (run #1) and subsequent cycles of a device with 15 bridges between the electrodes. The error bars on each data point are based on 10 points over a time period of 5 s. The resistance is measured by fitting a line through the origin with fitness parameter R^2. The $I-V$ characteristics become reproducible after the first run.

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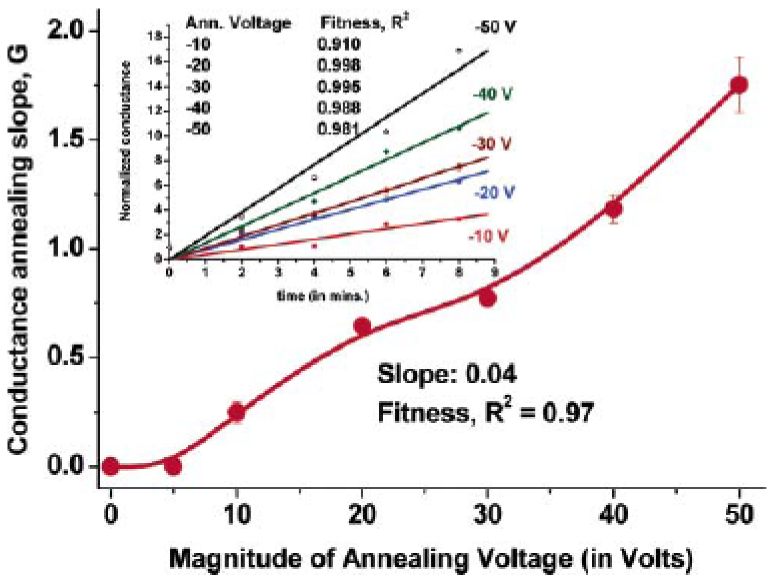

Figure 2. Normalized conductance is defined as R_i/R, where R_i is the resistance at $t = 0$ (i.e., after the third cycle in Figure 1). All the devices are on the same chip and therefore fabricated under identical conditions. The slope G is in min^{-1}.

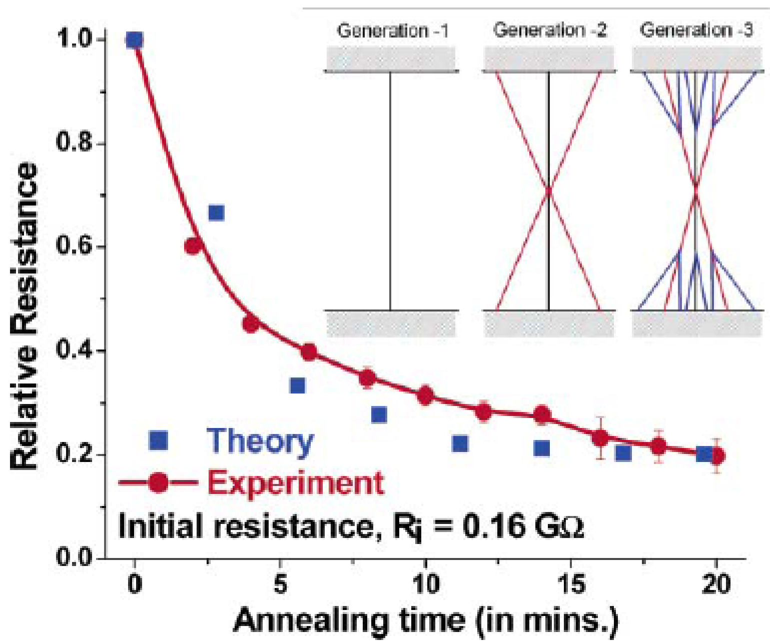

Figure 3. Annealing time versus relative resistance, R/R_i of a sample showing the plateau region after ∼20 min. The theory points are based on the percolation model for coordination number, $f + 1 = 4$. Inset shows three generations due to $f = 3$ branching. The channels are drawn as straight lines for simplicity.