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Analysis of Self-Terminated Pressure-Driven Quantum Point Contacts with Ultrafast Optical Pulses[1] FATEMEH SOLTANI, ALEX WLASENKO, GEOFF STEEVES, University of Victoria — A self-terminated electrochemical method was used to fabricate atomic-scale contacts between two Au electrodes in a microfluidic channel. The conductance of the contacts varies in a stepwise fashion. The mechanism works by a pressure-driven flow parallel with a pair of Au electrodes with a 100 μm gap in an electrolyte of HCl. Without applied flow, dendrite growth and dense branching morphology were typically observed at the cathode. The addition of applied pressure-driven flow resulted in a densely packed gold structure that filled the channel. The electrochemical fabrication approach introduces large variance in the formation and location of individual junctions. Understanding and controlling this process will enable the precise positioning of reproducible geometries into nano-electronic devices. To investigate the high speed behaviour of a QPC, it can be integrated with a transmission line structure patterned on a photoconductive GaAs substrate. The nonlinear conductance of the QPC (due to the finite density of states of the conductors) can be examined and compared with recent theoretical studies. Samples are fabricated in situ using an electrochemical procedure to produce QPCs along the transmission line structure. This method may provide insight into Terahertz Optoelectronic devices and ultrafast communication systems.

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