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Role of solvent environments in single molecule conductance used insulator-modified mechanically controlled break junctions.[1] NANDINI MUTHUSUBRAMANIAN[2], CHANDAN MAITY[3], ELENA GALAN GARCIA[4], RIENK EELKEMA[5], FERDINAND GROZEMA[6], HERRE VAN DER ZANT[7], Delft University of Technology, KAVLI INSTITUTE OF NANOSCIENCE COLLABORATION, DEPARTMENT OF CHEMICAL ENGINEERING COLLABORATION — We present a method for studying the effects of polar solvents on charge transport through organic/biological single molecules by developing solvent-compatible mechanically controlled break junctions of gold coated with a thin layer of aluminium oxide using plasma enhanced atomic layer deposition (ALD). The optimal oxide thickness was experimentally determined to be 15 nm deposited at ALD operating temperature of 300C which yielded atomically sharp electrodes and reproducible single-barrier tunnelling behaviour across a wide conductance range between 1 G_0 and 10^{-7} G_0. The insulator protected MCBJ devices were found to be effective in various solvents such as deionized water, phosphate buffered saline, methanol, acetonitrile and dichlorobenzene. The yield of molecular junctions using such insulated electrodes was tested by developing a chemical protocol for synthesizing an amphipathic form of oligo-phenylene ethynylene (OPE3-PEO) with thioacetate anchoring groups. This work has further applications in studying effects of solvation, dipole orientation and other thermodynamic interactions on charge transport.

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