Abstract Submitted
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Single-Molecule Diodes with High On/Off Ratios Through Environmental Control BRIAN CAPOZZI, Dept. of Applied Physics, Columbia University, JIANLONG XIA, EMMA DELL, Dept. of Chemistry, Columbia University, OLGUN ADAK, Dept. of Applied Physics, Columbia University, ZHEN-FEI LIU, JEFFREY NEATON, Molecular Foundry, LBNL, Berkeley, LUIS CAMPOS, Dept. of Chemistry, Columbia University, LATHA VENKATARAMAN, Dept. of Applied Physics, Columbia University — Single-Molecule diodes were first proposed with an asymmetric molecule comprising a donor-bridge-acceptor architecture to mimic a semiconductor p-n junction. Progress in molecular electronics has led to the realization of several single-molecule diodes; these have relied on asymmetric molecular backbones, asymmetric molecule-electrode linkers, or asymmetric electrode materials. Despite these advances, molecular diodes have had limited potential for functional applications due to several pitfalls, including low rectification ratios ("on"/"off" current ratios <10). Here, we introduce a powerful approach for inducing rectification in conventionally symmetric single-molecule junctions, taking advantage of environmental factors about the junction. By utilizing an asymmetric environment instead of an asymmetric molecule, we reproducibly achieve high rectification ratios at low operating voltages for molecular junctions based on a family of symmetric small-gap molecules. This technique serves as an unconventional approach for developing functional molecular-scale devices and probing their charge transport characteristics. Furthermore, this technique should be applicable to other nanoscale devices, providing a general route for tuning device properties.

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