

## Enhanced Stability and Fabrication of 1-D Molecular Lines on the H-Terminated Si(001) Surface

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We present a facile method for the self-directed growth of 1D molecular lines on the H-terminated Si(001) surface. The present method overcomes the existing problems in the self-directed growth process. Unlike the previous approach which employed a single DB as the reaction site, we here employ an H-free Si dimer which can be generated with the tip of the STM. For the reaction with the H-free dimer, we chose the O-phthalaldehyde ( $C_8H_6O_2$ : OP) molecule containing two carbonyl groups. The radical intermediate which is formed with two Si-O bonds between the carbonyl oxygens and the H-free Si atoms is found to be significantly more stabilized as compared to those of various alkenes which have a single Si-C bond. As a result, the present radical intermediate successfully achieves H-atom abstraction without its desorption, thereby allowing the chain reaction. The resulting OP line which is strongly bonded to the Si dimers with two Si-O bonds per molecule will survive heating up to higher temperatures compared to the previously reported alkene lines which have a single Si-C bond per molecule.