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**Towards bipolar atomic scale dopant devices defined by STM-lithography**[1] ANDREAS FUHRER, SIGRUN KÖSTER, NIKOLA PASCHER, IBM Research - Zurich, Säumerstrasse 4, 8803 Rüschlikon — Dopant device fabrication with hydrogen resist lithography has been demonstrated only for n-type dopants. The reason for this is the ease with which phosphorus can be incorporated and activated after gas phase doping with phosphine. Specifically, incorporation on the silicon (001) surface can be achieved at 350°C while keeping the hydrogen resist intact and thus avoiding surface diffusion of the dopants. Here, we present new results on p-type $\delta$-doping of silicon, towards the fabrication of bipolar dopant devices with hydrogen resist lithography. Using diborane as a gas-phase dopant source, Hall bar devices were fabricated to extract hole densities and mobilities in cryogenic magneto-transport experiments. Furthermore, the dependence of these parameters on diborane dose and dopant activation temperatures is investigated. We find that gas-phase doping with diborane is compatible with hydrogen resist lithography and dopant structures can be patterned using the STM. However, activation of the boron dopants currently still leads to significant diffusion and therefore blurring of the patterned devices. We will discuss the prospects of further optimising this and present a possible path forward towards bipolar atomic scale device fabrication with the STM.

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Andreas Fuhrer
IBM Research - Zurich, Säumerstrasse 4, 8803 Rüschlikon

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