

Hard Stamp Processes for the EVG 620 Full Field Nanoimprint System

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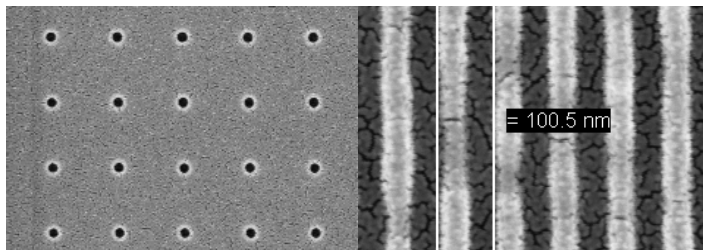
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The EVG 620 nanoimprint system is a 4" full wafer system suitable for university and research environments¹. This system has found application primarily with soft stamps, such as those made of polydimethylsiloxane (PDMS).² However, soft stamps can have limited resolution and are difficult to clean, meaning they must be disposed of after a single stamp. Hard stamps made from quartz wafers have ultimate resolution limited only by the e-beam exposure system used for definition and are easy to clean in sulfuric peroxide or oxygen plasma strippers.

Hard stamps have been demonstrated on the EVG 620 instrument at SNF with resolution down to 20 nm. Both positive tone (ZEP-520) and negative tone templates (HSQ) have been fabricated. The positive tone templates require a plasma etch step, while the HSQ templates³ can be used directly for nanoimprint.

A process for creation of daughter templates from silicon master e-beam exposures has been demonstrated on the EVG 620. The silicon master with HSQ patterns is placed on the wafer stage and a quartz wafer coated with nanoimprint polymer (Microchem MrUV21) is mounted where the template is normally placed. The resultant image on the quartz wafer is then transferred into the substrate with plasma etching, and these daughter templates can then be used for image transfer. Minimal loss of resolution has been demonstrated with this process.

1. http://www.evgroup.com/en/products/lithography/nil_systems/evg620_uv-nil/
2. U. Plachetka, A. Fuchs, M. Bender, B. Vratzov, T. Glinsner, F. Lindner and H. Kurz, "Wafer scale patterning by soft UV-nanoimprint lithography", *Microelectronic Engineering*, **73-74**, 167 (2003).
3. D.P. Mancini, K.A. Gehoski, E. Ainley, K.J. Nordquist, D.J. Resnick, T.C. Bailey, S.V. Sreenivasan, J.G. Ekerdt, and C.G. Willson, "Hydrogen silsequioxane for direct electron-beam patterning of step and flash imprint lithography templates", *J. Vac. Sci. Technol.* **B20**, 2896 (2002).



60 nm contacts and 100 nm pitch lines and spaces in nanoimprint resist transferred from an HSQ on silicon master onto a quartz daughter template.