Optimizations on the conductive electron beam coating Electra 92 and the HSQ-alternative Medusa 82

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Allresist and the Fraunhofer Institute for Electronic Nanosystems (ENAS) present the latest research results from a selection of Allresist products. On the one hand, we report on our HSQ alternative, the Medusa 82, and on the other hand, we can present the first results of our current Electra 92 variant, the AR-PC 5092.02, which is a protective electron beam coating used to minimize charging.

With Medusa 82, Allresist offers an alternative to the well-known HSQ resist. In contrast to HSQ, Medusa 82 is characterized by a higher process stability and a longer shelf life without quality loss. The resist shows high resolution. Furthermore, the fabrication of diffractive optical elements is possible by means of grayscale lithography. Through further investigations at Fraunhofer ENAS, we can show current results on PEB investigations, resolution limits, contrast curves as well as investigations on long-term stability and resist removal. The first investigations showed that the weaker the PEB, the lower the resist thickness and thus, the weaker the contrast in the SEM.
A conductive layer for discharging is essential for electron beam exposures on insulating substrates. Furthermore, measurements obtained by SEM may be prone to charging and thus suffer from a significant loss of image quality. Usually in SEM this is circumvented by a coating of a carbon or metal layer. This layer unfortunately cannot be easily removed. Allresist offers a great solution with the Electra 92, which is a conductive, protective coating based on a polyaniline derivative to dissipate charges during electron irradiation. The layer is easily solvable in DI water and thereby a perfect solution for in-line metrology. With the latest results from research and development, it is possible to launch a new Electra 92 variant, the AR-PC 5092.02. The new variant is characterized by its high shelf life and green features, *e.g.* the protective coating is water-based and contains biodegradable surfactants. Accordingly, as mentioned above, the removal can be easily done with water. A comparison of PMMA processing with and without AR-PC 5092.02 is shown in Figure 1. AR-PC 5092.02 prevents the structures from shifting, which spoils the electrical properties of the exposed coil.

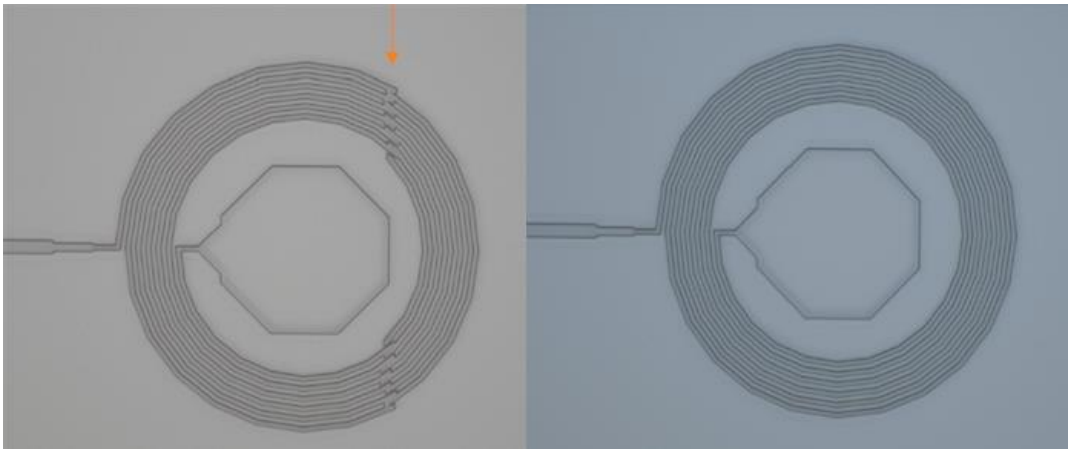

Figure 1: left - Si / 2µm SiO_2 / 400nm PMMA / without AR-PC 5092.02, right - Si / 2µm SiO_2 / 400nm PMMA / with AR-PC 5092.02. The orange arrow in the left image marks the shift of the structures when processing PMMA without AR-PC 5092.02, which do not occur when processing PMMA on insulating substrates with AR-PC 5092.02 as in the right image.