



AR NEWS

53rd Issue, April 2026, Allresist GmbH



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Welcome to our 53rd issue of the AR NEWS.

Allresist continues to develop constantly. The resists developed over the past five years now account for almost 40% of product turnover and are in demand worldwide.

We remain true to our philosophy: new products are brought to market in response to customer demand, and tailored resists are developed to match the technologies of industrial clients.

As in every April and October, we would like to keep you informed about the ongoing development of our company and its research projects.

1. Allresist at the EIPBN (USA), MNE (Switzerland) and SEMICON Europa conferences



The EIPBN conference will take place this year in the Midwestern United States, in Denver, from May 26 to 29, 2026. As with every previous conference, we are registered as a Gold Sponsor and will have an informative stand. This conference is a perfect fit for us, as our flagship products CSAR 62, Electra 94, and Medusa 84 SiH are of great interest to electron beam users.



From September 21 to 24, 2026, we will then attend the MNE conference in Interlaken, Swit-

zerland, where we will also be represented with a representative stand as a Silver Sponsor. Naturally, the aforementioned resists for electron beam applications will be the main focus, but a wide range of innovative products from the field of photolithography will also be on display again. At the congress, Allresist will present various bottom resists that enable precise lift-off processes within two-layer lithography in combination with either negative or positive resists.



We will also be present at SEMICON Europa from November 10 to 13, 2026 in Munich, where we will showcase our entire product portfolio and meet with key partners and customers. If you are interested, you are welcome to arrange a meeting with us, for which we can provide visitor tickets. Please feel free to get in touch ☺.

2. The established HSQ resist Medusa 84 SiH

Our HSQ resist Medusa 84 SiH has become firmly established on the market. It is characterised by extremely high resolution, excellent etch stability and long shelf life. With four solids contents, a film thickness range from 40 nm to 800 nm can be achieved, and with double coating, thicknesses exceeding 1 µm are possible. We would like to summarise its outstanding properties and provide some additional details below.

Improved properties

a) Longer shelf life (> 6 months)

Medusa 84 SiH consists chemically of pure HSQ polymer dissolved in butyl acetate. Through carefully controlled synthesis and extensive purification processes, we are now able to offer a more storage-stable HSQ resist. With a solids content of up to 8% (AR-N 8400.08), storage times of more than six months in a standard refrigerator are possible without any loss of quality.

b) Higher sensitivity

A comparison of the sensitivity with a commercially available HSQ resist under identical conditions showed a higher sensitivity of Medusa 84 SiH:

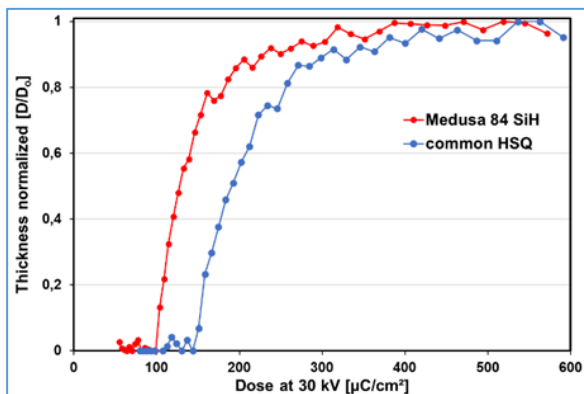


Fig. 1 Comparison of the sensitivities of Medusa 84 SiH and HSQ resist, developer AR 300-73, © Heyroth, MLU, Halle

c) Higher resolution & process stability

Joanne Schieser from Raith GmbH compared Medusa 84 SiH (8400.02 with 2% solids content) with a 2% HSQ resist of another manufacturer in powder form. The smallest line width was determined using a Raith Voyager EBL System at 50 kV. The structures of Medusa 84 SiH immediately after coating (3.6 nm) were superior to those of the powder HSQ (5.2 nm). The structure widths 65 days after coating were 5.9 nm for Medusa 84 SiH and 6.9 nm for the HSQ powder, which demonstrated that Medusa 84 SiH exhibits higher resolution even after 65 days.

d) Layer thicknesses > 1 µm possible

For certain applications, layer thicknesses > 1 µm are required. A double-coating process using AR-N 8400.22 with precise control of parameters was demonstrated at FZ Jülich. In the example shown here (Fig. 2), a layer thickness of 1.035 µm was achieved (see [52nd AR NEWS](#)).

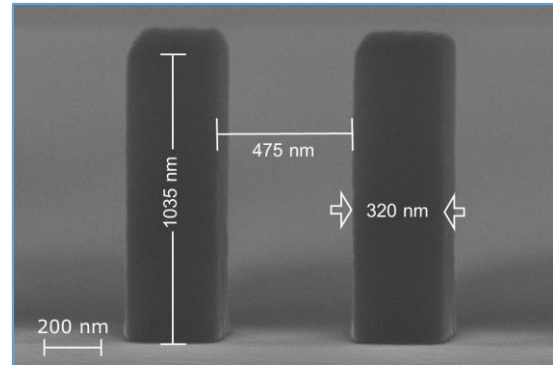


Fig. 2 Pillars generated with SX AR-N 8400.22, 100 kV, 600 µC/cm², developer AR 300-73, © Dr. Yurii Kutovyi Peter Grünberg Institute (PGI-9) & JARA-FIT, FZ Jülich

e) Improved storage stability

Further investigations by Raith GmbH focused on the storage stability of Medusa 84 SiH with 2% solids content under different conditions. Samples were stored for 3.5 months at -30 °C, at 0 °C, and at room temperature. Again, the smallest line width was determined with the same procedure. Remarkably, no differences were observed between the three storage temperatures; even the sample stored at room temperature showed a line width of 3.7 nm.

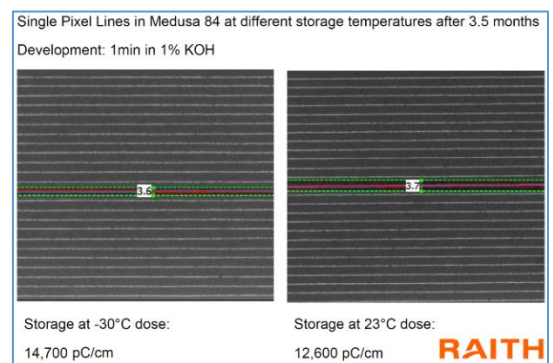


Fig. 3 Line widths comparison of Medusa 84 with 2% solids content kept at different storage temperatures

Publications

The publication "[Medusa 84 SiH – A Novel High-Selectivity Electron Beam Resist for Diamond Quantum Technologies](#)" demonstrates that Medusa 84 SiH (HSQ), as an electron-beam resist, offers a lithographic performance comparable to FOx, along with high etch resistance and good process integration for ICP-RIE-based diamond

nano-structuring. By employing a silicon adhesion layer and established process protocol, high structural quality and fabrication yields of NV centre yields in diamond of up to approximately 96% are achieved, while maintaining excellent surface quality. Crucially, the NV centres undergo minimal degradation following processing, making Medusa 84 a suitable drop-in replacement for FOx, with the added advantages of a less toxic solvent and immediate availability.

Medusa 84 has also been well received in the scientific press. The following articles have been published:

EPP – Elektronik Produktion + Prüftechnik “[Wie anorganische Resists neue Maßstäbe in der Elektronenstrahlithographie setzen](#)” [German]

Elektronik Praxis “[HSQ-basierte Resists als Treiber in der E-Beam-Lithographie](#)” [German]

Both articles draw the following conclusion regarding the HSQ resist Medusa 84 [translation]:

“HSQ-based resists such as Medusa 84 open up entirely new possibilities for electron beam lithography when it comes to high-resolution, etch-resistant and at the same time process-reliable applications. The combination of structural precision, robust processing, high storage stability and excellent drop-in compatibility makes them attractive for both research institutions and industrial users.”

Various application examples

Medusa 84 SiH has been used in different applications. Selected examples are shown below:

a) Donut structures of Medusa 84 SiH on GaN

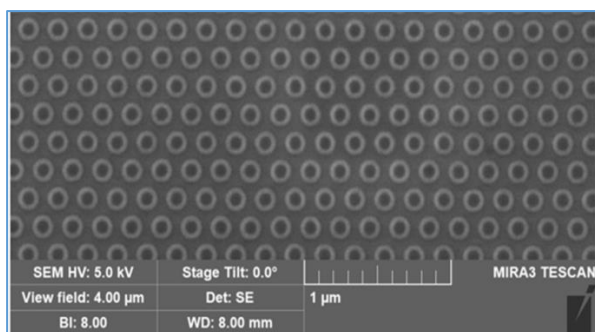


Fig. 4 © F. Lützmann, PTB Braunschweig

The saline developer AR 300-28 (1% NaOH + 4% NaCl) was used to significantly improve contrast.

b) Circular 100 nm line/space structures with Medusa 84 SiH

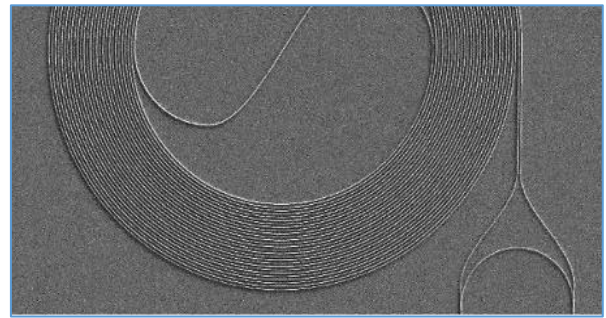


Fig. 5 © J. Hohmann, KIT-IMT, Karlsruhe

Exposure was carried out at 1000 $\mu\text{C}/\text{cm}^2$ and 100 kV on silicon, followed by development with AR 300-73 (6.5% TMAH solution).

c) Square pillars of Medusa 84 SiH with 22 nm edge length and 50 nm height on GaAs

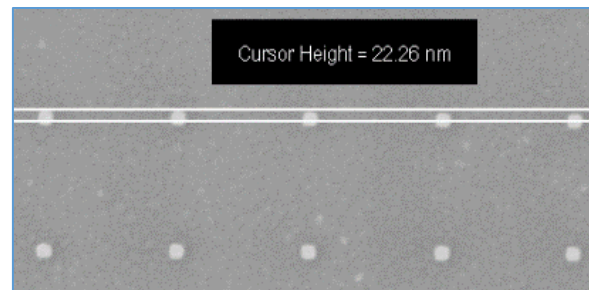


Fig. 6 © E. Maggolini, JKU Linz

Structures were written at 30 kV and developed with AR 300-44 (2.38% TMAH).

d) Structuring of Medusa 84 on insulating substrates

When structuring Medusa 84 on insulating substrates such as quartz, the new variant of Electra 94 is ideally suited. This conductive resist is spin-coated onto Medusa 84 SiH and dissipates charges during exposure. The Electra layer offers excellent coating and adhesion properties and is not only suitable for Medusa 84 SiH but also for other HSQ resists.

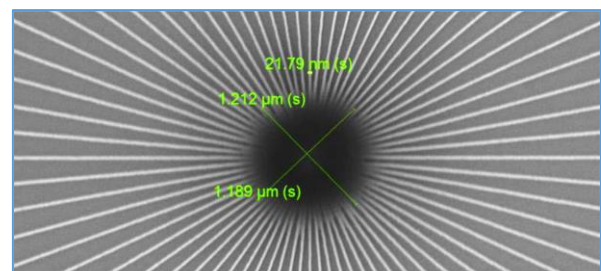


Fig. 7 Medusa 84 Siemens star, written on quartz with the new conductive layer Electra 94 AR-PC 5094.02 © B. Drent, AMOLF NanoLab Amsterdam

3. Phoenix 81 also available as a PPA liquid resist for the NanoFrazor

The NanoFrazor of Heidelberg Instruments Nano AG has become well-established worldwide.

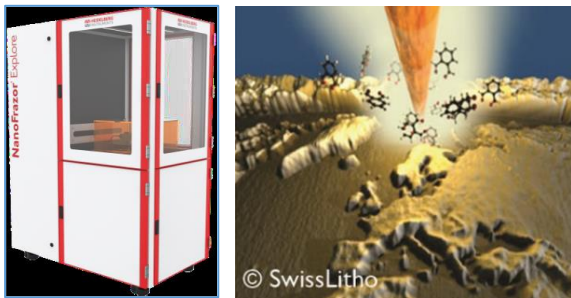


Fig. 8 (left) NanoFrazor of Heidelberg Instruments Nano AG
Fig. 9 (right) Three-dimensional structuring using the NanoFrazor

NanoFrazor systems are t-SPL (thermal scanning probe lithography) devices that enable binary lithography with a resolution of less than 10 nm and 3D structuring with vertical resolution in the sub-nm range. The heated tip sublimates Phoenix 81 and can also perform in-situ imaging similar to AFM.

In collaboration with Heidelberg Instruments Nano AG, Allresist developed the PPA resist Phoenix 81 as part of a Eurostars project. This resist has been successfully marketed worldwide for several years.

The fact that the Phoenix 81 polymer (polyphthalaldehyde) is designed to decompose during structuring already indicates its thermal instability, and indeed, the first liquid samples were stable for only a few weeks. Phoenix 81 had thus previously been sold exclusively as a solid PPA which, when stored appropriately, remains stable for over 12 months, but users have to prepare the resist mixture themselves, making it difficult to precisely regulate the desired film thickness.

Our next goal was thus to develop a user-friendly liquid PPA resist and we revised the production process in cooperation with our long-standing partner IDM e.V. (Institut für Dünnschichttechnologie und Mikrosensorik e.V., Teltow). The improved procedure enabled a significantly higher purity of the polyphthalaldehyde. In parallel, Allresist assessed the stability of the new Phoenix 81 resist samples.

For these studies, resists with a solids content of 6% were prepared in the solvent anisole. The samples were stored at $-18\text{ }^{\circ}\text{C}$, $10\text{ }^{\circ}\text{C}$, room temperature, and in an oven at $40\text{ }^{\circ}\text{C}$. Wafers were coated at monthly intervals, and both the film thickness and the decomposition temperature were meas-

ured. To determine the decomposition temperature, the wafer was first placed on a hotplate at $100\text{ }^{\circ}\text{C}$ and then heated at a rate of $5\text{ }^{\circ}\text{C}$ per minute. Complete evaporation was visually assessed.

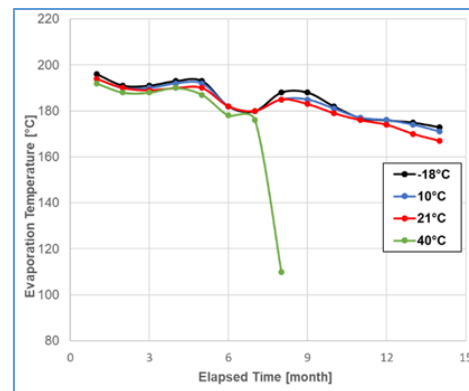


Fig. 10 Decomposition temperature as a function of storage time

The investigations confirm that even when stored at room temperature, the resist remains usable after 12 months. Even samples stored at $40\text{ }^{\circ}\text{C}$ can still be used without any problems after six months.

Tests carried out at Heidelberg Instruments Nano AG also demonstrated that the improved PPA resist Phoenix 81 retained its excellent application properties even after three months of storage at room temperature.

Based on these positive results, we have been offering the ready-to-use Phoenix 81 alongside the powdered PPA since this year. We also provide starter kits with the e-beam resist AR-P 617.06 for a two-layer process. In this process, AR-P 617 is first coated, followed by the application of Phoenix 81. The PPA is then structured using the NanoFrazor, after which the exposed AR-P 617 is removed using an aqueous-alkaline developer. This development step also removes the layer beneath the PPA, creating a lift-off structure. The lift-off level can be precisely adjusted via the development time.

4. Environmentally friendly alternatives to TMAH- and NEP-based process chemicals

Lithography processes in semiconductor-

and nanotechnology are increasingly faced with the challenge of combining the highest demands for resolution, reproducibility and process stability with growing expectations in terms of occupational safety and environmental protection.

In photolithography, developers and removers are among the most critical process chemicals. TMAH-based developers and NEP-based remov-

ers have been well-established for many years and enable reliable processing. At the same time, however, they must be viewed critically from both an occupational safety and an environmental perspective.

For example, we are investigating carbonate-based removers as an alternative to NEP. Internal trials with various resists are already well advanced. Samples are currently being prepared for some of our customers who will test these new environmentally friendly removers for their own technologies.

We have progressed even further in our investigations of choline-based developers as a replacement for TMAH. In collaboration with Fraunhofer ENAS in Chemnitz, the developers AR 300-41 and 300-42 for Medusa 84 SiH were designed. The excellent results were presented last year at the MNE in Southampton (see [52nd AR NEWS](#)).

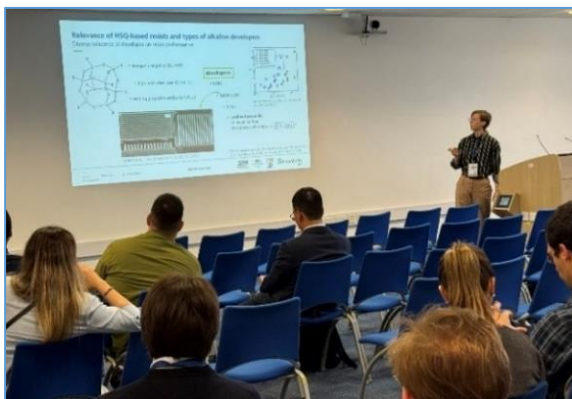


Fig. 11 Pia Kohlschreiber from Fraunhofer ENAS presents the joint investigations for the development of Medusa 84 SiH with the choline-based developer AR 300-41.

In the meantime, a ready-to-use formulation has also been developed as an alternative to the standard developer AR 300-44 (2.38% TMAH), which has been successfully tested with our positive and negative resists (AR-P 3500 T and AR 4400).

We hope you found something of interest and inspiration in this issue and appreciate your feedback. The next issue of AR NEWS will be presented in October 2026. Until then, we wish you and ourselves every success 😊.



Strausberg, 28.04.2026
Matthias, Brigitte, and Ulrike Schirmer in the Allresist team

Further investigations are ongoing to provide suitable alternatives for other commonly used developer concentrations. We regard this work as an important contribution to protecting the health of our users and enhancing sustainability within the chemical industry. We expect to include these environmentally friendly process chemicals in our product portfolio in 2027.

If you are interested, please feel free to contact us for further information.

5. Allresist expands and starts construction of building extension in May

Due to steadily increasing product sales, we require larger production, shipping, and storage capacities.

We had therefore already planned in 2025 to construct a new facility for shipping and logistics. This expansion will free up space in the existing building for new production capacities. At the same time, we are investing in more efficient manufacturing and packaging processes. A new semi-automatic filling station will enable us to package increased product volumes.

We are pleased to report that the Investment Bank of the State of Brandenburg (ILB) has approved our application for GRW funding. The construction costs will be subsidized at 45%. This secures the financing of the project without the need for external loans. We thank the ILB and the State of Brandenburg for their generous support.

The building permit was granted last week, and construction of the expansion with the company Goldbeck will start at the beginning of May. Completion is planned for the end of this year. We will keep you updated on the progress in our next AR NEWS.