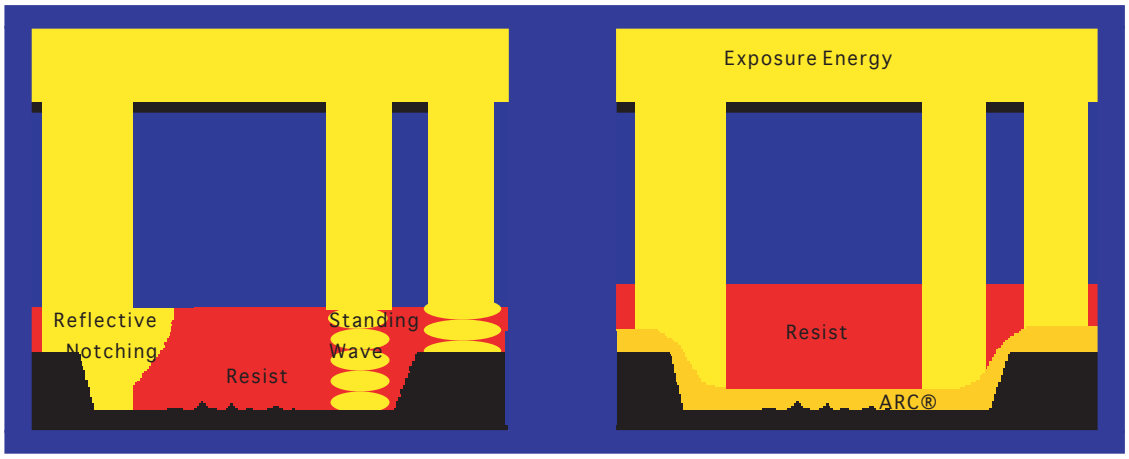
Anti-Reflective Coatings

Product Overview

Bottom anti-reflective coatings (BARC's) are designed for use in the photolithography step of semiconductor manufacturing. They are specifically designed to control reflection of exposure energy from the substrate. BARC's improve the photolithography process by eliminating reflective notching, thereby controlling CD variation caused by exposure light and eliminating standing waves.



The ARC Division of Brewer Science, Inc. holds many of the fundamental patents in the photolithography field and is the leading innovator in BARC technology. As a producer of BARCs for 20 years, Brewer Science, Inc. is a leader in developing innovative solutions for the emerging issues in the industry. Research and development efforts are focused on 157nm lithography processes as well as the development of new generation materials for 193nm, DUV and i-line processes. Recently, the ARC Division launched many Dual Damascene compatible materials and 300mm wafer processing materials.

Brewer Science, Inc. has poised itself as a leader in technology, to not only ride the wave of the information revolution but to soar above it. Brewer Science, Inc. can be described as a company whose business directive is to design and produce materials and equipment that are utilized in the collection, processing and output of information. These products and services will help improve the quality of life now and in the future. Brewer Science's employee-base is rich in problem solvers and technological risk takers with a pioneering spirit. Without exception the ARC products are "firsts" both conceptually and in practice. As the recognized leader in BARC technology we introduce products that capture our competitors' attention, challenge the conventional approach, and help solve our customer's lithography problems.

ARC

TECHNOLOGY TO BUILD ON™

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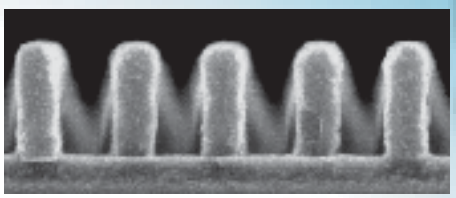
◆ 193nm Bottom Anti-Reflective Coating

The accelerated roadmap for reduced feature sizes and increased thoughput has created a challenge for the development of 193nm BARCs. The challenge is being met with our newest line of anti-reflective coatings, designed to meet the emerging needs of the 193nm photo process.



Feature size 0.10 μm
ARC®25

ARC®25 ARC25 is designed to provide optimum reflectance control at the second thickness/ reflectance minimum (780Å) for leading acrylic based photoresists. It is a planarizing BARC with an etch rate exceeding photoresist to assist the etch budget.

ARC®27 ARC27 is formulated for optimum use at the first minimum (280Å). This is a thin BARC layer, which provides excellent optical protection and improved etch selectivity.

Product	n	k	Cauchy A	Cauchy B	Cauchy C
ARC 25	1.84	0.46	1.52	6.0 E-3	0.0
ARC 27	1.75	0.52	1.55	9.3E-3	0.0

◆ Advanced DUV Bottom Anti-Reflective Coating

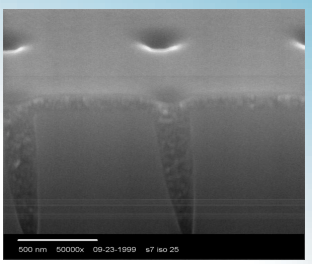
These anti-reflective coating products are specifically formulated for 248nm lithography and can be used for poly, contact, via, and metal levels. By producing a thin film that reduces substrate reflectivity phenomena, CD control is increased, process control is improved, and standing waves and reflective notching are eliminated. These materials open the door to DUV process at 0.15μm and below.

DUV74 DUV74 is the newest conformal product in the DUV product line. With demonstrated etch rates of three times that of traditional BARC at a given etch recipe, this product advances the expectations of BARC performance.

DUV64 DUV64 is a member of the latest generation of anti-reflective coatings. Designed to be compatible with Acetal photoresists, DUV64 demonstrates superior optical and coat qualities which allow it to be coated considerably thinner than previous series. The advanced capability of this BARC enables faster throughput time, with a demonstrated etch rate of over two times faster than traditional BARCs.

DUV54 DUV54 was designed for use in dual damascene processes and is compatible with Acetal DUV photoresists. Its planarizing characteristics ensure the ability for better control of resist thickness over steps to minimize reflective notching and improve CD control.

DUV52 DUV 52 is specifically designed to be compatible with ESCAP DUV photoresists and for use in the dual damascene process. Its planarizing characteristics ensure better control of resist thickness over steps to minimize reflective notching and improve CD control.



DUV44 DUV44 is designed for 0.18μm design rules, DUV44 demonstrates excellent profiles with a broad range of Acetal photoresists. This product provides a highly conformal, fast etching BARC layer.

DUV42P DUV42P is compatible with ESCAP photoresists. DUV42P utilizes a conformal design and an increased etch rate while optimizing step coverage. DUV42P is optimized to meet the requirements of the <0.12μm design rule.

DUV32 DUV 32 is a planarizing, thermal crosslinking BARC, compatible with Acetal photoresists.

DUV30J Compatible with t-BOC and ESCAP resists, this BARC uses a planarizing design and a thermal crosslinking system to reduce reflective notching and increase CD control.

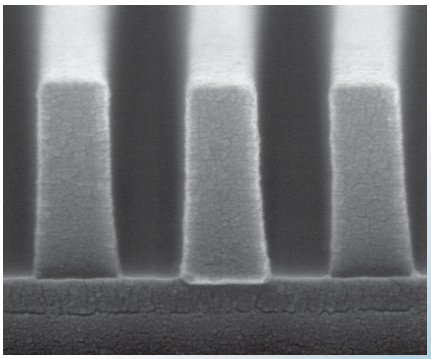
CD11 This BARC is based on the original DUV dry patterning BARC. It is optimized for use with APEX® photoresist and designed to be insoluble in aqueous base developers. It has demonstrated as effective down to 0.2μm design rules.

◆ i-Line Bottom Anti-Reflective Coating

This family of products includes anti-reflective coatings specifically designed for sub 0.5μm for i-line (365nm) lithography. This series provides increased CD control by eliminating standing waves and reflective notching.

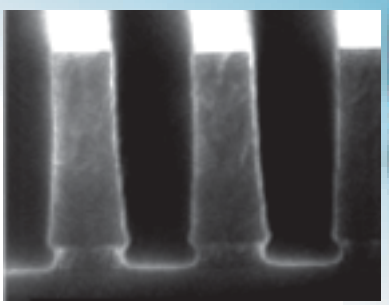
ARC i-CON™ ARC i-CON is the newest addition to the i-line product line, ARC i-CON is a highly conformal product designed to address issues of coverage and over-etch, offering in a 30% faster etch rate than most advanced i-line photoresists. This series delivers exceptional optical properties, to control optimal substrate reflectivity and improve CD resolution. At 0.35μm feature, the series gives excellent profiles, and has demonstrated feature sizes of 0.25μm with PFI-88.

XHRiC XHRiC is a highly robust product line specifically designed for advanced i-line dry patterning processes. This optical design with an n-value of 1.84 and a k-value of 0.34 gives excellent absorbance. These products have been employed in poly, gate and metalization levels for 0.35-0.30μm design rule devices. With continuous improvements in lithography technologies 0.25μm feature sizes have been resolved.



WiDE™

WiDE is specifically designed for wet patterning which eliminates the need for a substrate adhesion promoter and separate BARC etch. The extended bake latitude and advanced optical characteristics allow the wet patterning process to acheive 0.4 to 0.35m patterns. WiDE is especially useful as a platform for a separation layer which serves as a lift-off application in devices such as SAWs (surface acoustic wave guides).



◆ g-Line Bottom Anti-Reflective Coating

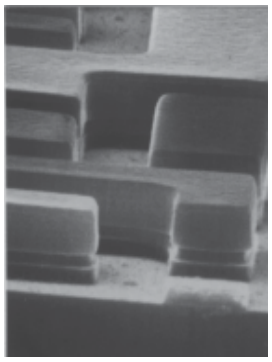
Brewer Science, Inc. offers the only wet developable g-line BARCs in the marketplace. These materials provide absorbance for both g and i-line patterning and allow the extension of feature resolution to submicron levels. These anti-reflective coatings provide increased CD control, eliminate standing waves, and minimze reflective notching.

XLT

This primary g-line and i-line wet-patterning product utilizes its increased absorbance in order to extend patterning processes into the sub-micron region.

XLX

This series reduces the footing of the resist profile seen at the ARC/Resist interface. The increased processing latitude and high absorbency level allow these materials to be used in sub-micron processing.



◆ Ancilliary Products

These are specialty solvents designed to help clean equipment and maintain the efficiency of products and marketed by Brewer Science.

EBC

A proprietary solvent mixture used to remove the edge bead of photoresists and BARC materials from wafers, bowls and spin-coating equipment.

ARC® Cleaner

A non-caustic and non-phenolic formulation designed to remove BARC coatings and photoresist from wafers and equipment in one step.

BARC Product Overview

Product	Resolution μm	Etch Process	Coverage	Exposure	Thickness Å	BakeTemp °C	Compatible Resist
ARC®25	<0.13	Dry	Planar	193 nm	780	205	PAR700 series
ARC®27	<0.13	Dry	Planar	193nm	280	205	PAR 700 series
DUV74	<0.13	Dry	Conformal	248nm	800	205	Acetal
DUV64	>0.15	Dry	Conformal	248nm	900	205	Acetal
DUV54	≥0.15	Dry	Planar	248nm	1400	205	ESCAP
DUV52	≥0.15	Dry	Planar	248nm	1400	205	ESCAP
DUV44	≥0.15	Dry	Conformal	248nm	600-1100	175-205	Acetal
DUV42P	≥0.12	Dry	Conformal	248nm	600-1100	175-205	t-BOC, ESCAP
DUV32	>0.20	Dry	Planar	248nm	600-1600	175-205	Acetal
DUV30J	>0.18	Dry	Planar	248nm	600-1600	175-205	t-BOC, ESCAP
CD-11	>0.20	Dry	Conformal	248nm	750-1100	225	APEX
ARC i-CON™	>0.25	Dry	Conformal	365nm	1600-2100	180-205	Std i-line resists
XHRiC	>0.25	Dry	Planar	365nm	1000-1600	175-205	Std i-line resists
WiDE™	>0.35	Wet		365nm	800-1500	135-170	
XLT	>0.5	Wet		436/365nm	400-1300	135-170	
XLX	>0.5	Wet		436/365nm	1300-2000	135-170	

Disclaimer: Processing conditions mentioned above are generalized and for generic processes. Process optimization, Bake temperature and time must be optimized for individual systems.

Brewer Science, Inc.

Founded in 1981 Brewer Science, Inc. (BSI) has grown to be a worldwide supplier of specialty materials and equipment to microelectronics and opto-electronics manufacturers. The technologies of Brewer Science can be found in products such as computers, cameras, video recorders, cellular phones, medical instrumentation, telecommunications equipment, automobiles, games, and flight instrument displays on military aircraft, NASA's space shuttle and commercial aircraft. Brewer Science consists of 3 principal operating divisions;

Chemical Solutions - ARC® Anti-Reflective Coatings - world's leading supplier of BARC's which are utilized to enhance the photolithography process and OM - Optical Materials - the only US based manufacturer of color filter resins and patterned glass for use in flat panel displays

Equipment Solutions - Cee® Cost Effective Equipment - a leading supplier of customized coat and bake equipment utilized in processing of silicon wafers and other substrates,

R&D - Research and Development - provides support and innovation for the various divisions as well as maintaining a high level of expertise in polymeric materials, organic colorants, light-absorbing polymers, and characterization of polymer thin film electrical properties.

All statements, technical information and recommendations contained herein are based on tests we believe to be accurate, but the accuracy or completeness thereof is not guaranteed and the following is made in lieu of warranty expressed or implied. Neither the seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising from the use or inability to use the product. Before using, user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of the seller and manufacturer.

ARC®, is a registered trademark of Brewer Science, Inc, Rolla, Missouri, USA, WiDE™ and ARC i-CON™ applications are pending.

Selected Brewer Science U.S. issued BARC related patents

For a complete listing see our web site.

- U.S. Patent No. 4,910,122 Anti-Reflective Coating. March 1990
- U.S. Patent No. 5,110,697 Multifunctional Photolithographic Compositions. May 1992
- U.S. Patent No. 5,234,990 Polymers with Intrinsic Light-Absorbing Properties for Anti-Reflective Coating Applications in Deep Ultraviolet Microlithography. August 1993
- U.S. Patent No. 5,368,989 Photolithographic Article Utilizing Polymers with Light-Absorbing Properties for Anti-Reflective Coating. November 1994
- U.S. Patent No. 5,401,613 Method of Manufacturing Microelectronic Devices Having Multifunctional Photolithographic Layers. March 1995
- U.S. Patent No. 5,674,648 Anti-Reflective Coating. October 1997
- U.S. Patent No. 5,693,691 Thermosetting Anti-Reflective Coatings Compositions. Dec. 1997
- U.S. Patent No. 5,892,096 Non-Subliming Mid-UV Dyes And Ultra Thin Organic ARCs Having Differential Solubility. April 1999
- U.S. Patent No. 5,919,598 Method For Making Multilayer Resist Structures With Thermosetting Anti-Reflective Coatings. July 1999
- U.S. Patent No. 5,919,599 Thermosetting Anti-Reflective Coatings At Deep Ultraviolet. July 1999
- U.S. Patent No. 5,935,760 Thermosetting Polyester Anti-Reflective Coatings For Multilayer Photoresist Processes. August 1999
- U.S. Patent No. 6,156,479 Thermosetting Anti-Reflective Coatings. December 2000
- U.S. Patent No. 6,080,530 Thermosetting Polyester Anti-Reflective Coatings For Multilayer Photoresist Processes. June 2000
- U.S. Patent No. 5,935,760 Thermosetting Polyester Anti-Reflective Coatings For Multilayer Photoresist Processes. June 2000