SHIPLEY

# MICROPOSIT® S1800® SERIES PHOTO RESISTS

MICROPOSIT S1800 SERIES PHOTO RESISTS are positive photoresist systems engineered to satisfy the microelectronics industry's requirements for advanced IC device fabrication. The system has been engineered using a toxicologically safer alternative casting solvent to the ethylene glycol derived ether acetates. The dyed photoresist versions are recommended to minimize notching and maintain linewidth control when processing on highly reflective substrates.

## MICROPOSIT S1800 SERIES PHOTO RESISTS FEATURE:

### Product Assurance

- Lot-to-lot consistency through state-of-the-art physical, chemical and functional testing
- Filtered to 0.2 µm absolute

### Coating Properties

- [1]Cellosolve® Acetate and xylene free
- Striation-free coatings
- Excellent adhesion
- Excellent coating uniformity
- A variety of standard viscosities are available for single-layer processing

### Exposure Properties

- Optimized for G-Line exposure
- Effective for broad-band exposure
- Reflective notch and linewidth control using dyed versions

### Develop Properties

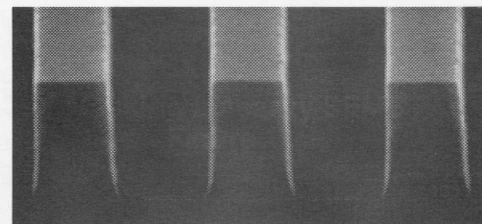
- Optimized for use with the MICROPOSIT® MF®-319 Metal-Ion-Free DEVELOPER family
- Compatible with Metal-Ion-Bearing MICROPOSIT DEVELOPERS

### Removal Property

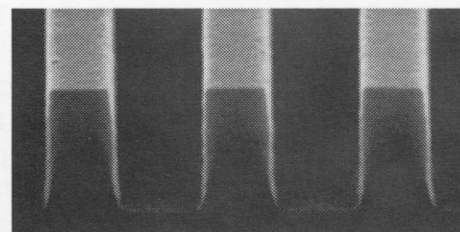
- Residue-free photoresist removal using standard MICROPOSIT REMOVERS

| High Resolution Process Parameters (Refer to Figure 1) | |
|---|---|
| Substrate: | Polysilicon |
| Photoresist: | MICROPOSIT® S1813® PHOTO RESIST |
| Coat: | 12,300Å |
| Softbake: | 115°C/60 sec. Hotplate |
| Exposure: | Nikon 1505 G6E, G-Line (0.54 NA), 150 mJ/cm² |
| Develop: | MICROPOSIT® MF®-321 DEVELOPER<br>15 + 50 sec. Double Spray Puddle (DSP) @ 21°C |

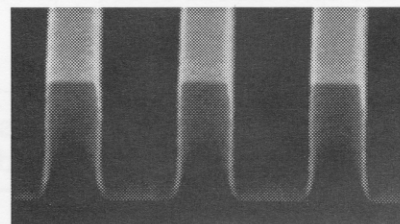
[1]Registered trademark of Union Carbide Corporation



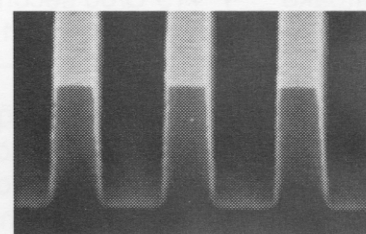
0.80 µm Lines/Spaces



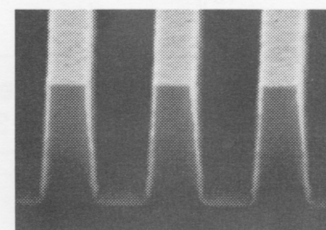
0.70 µm Lines/Spaces



0.60 µm Lines/Spaces



0.50 µm Lines/Spaces



0.48 µm Lines/Spaces

**Masking Linearity SEMS**
**Figure 1.**

## Instructions for Use

The following instructions cover the use of MICROPOSIT S1800 SERIES PHOTO RESISTS for all levels of microelectronic device fabrication. Exact process parameters are application and equipment dependent.

## Substrate Preparation

MICROPOSIT S1800 SERIES PHOTO RESISTS work well with the hexamethyldisilazane based MICROPOSIT PRIMERS. Concentrated MICROPOSIT PRIMER is recommended when vacuum vapor priming. Diluted PRIMER is recommended for liquid phase priming applications.

## Coat

MICROPOSIT S1800 SERIES PHOTO RESISTS provide uniform defect-free coatings over a wide range of film thicknesses. The film thickness versus spin speed plots displayed in **Figures 1 and 2** provide the information required to properly select a MICROPOSIT S1800 PHOTO RESIST version to meet process dependent thickness specifications. Maximum coating uniformity is typically attained between the spin speeds of 3500 rpm and 5500 rpm.

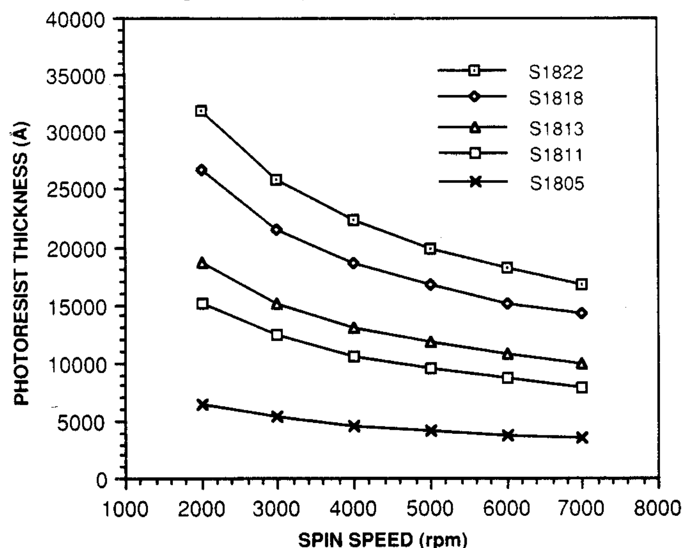
| Process Parameters (Refer to Figures 1 and 2) | |
|---|---|
| Substrate | Silicon |
| Coat | SVG 81 |
| Softbake | 115˚C/60 seconds Hotplate |
| Measure | Nanometrics 210 |

The dispersion curve and Cauchy equation displayed in **Figure 3** describe how the refractive index of the photoresist film varies as a function of the wavelength of light incident upon the film. This information is required to program ellipsometric and other optically based photoresist measuring equipment.

| Process Parameters (Refer to Figure 3) | |
|---|---|
| Substrate | Silicon |
| Coat | 13,675Å |
| Softbake | 115˚C/60 seconds Hotplate |
| Measure | Prometrix SM300 |

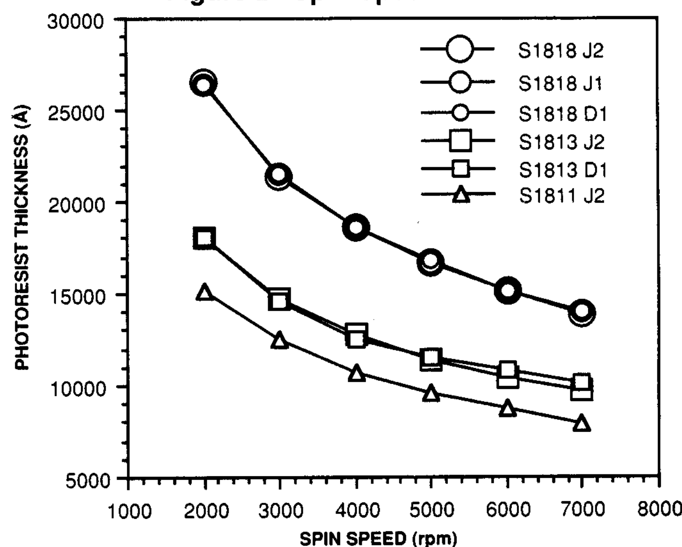
**MICROPOSIT S1800 PHOTO RESIST UNDYED SERIES**

**Figure 1. Spin Speed Curves**



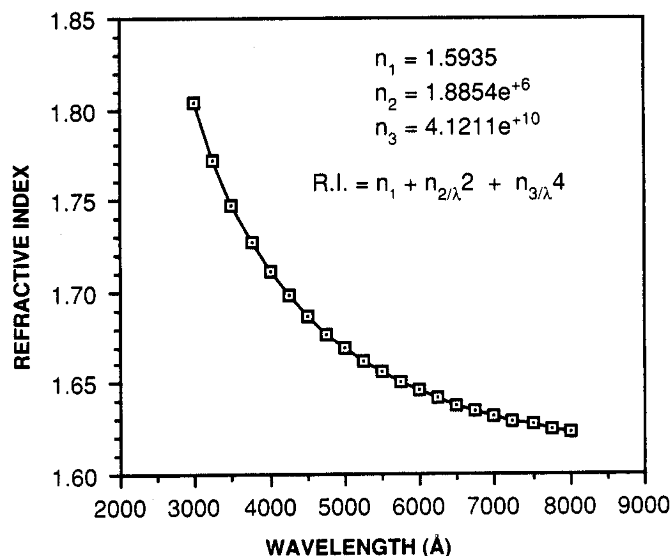

**MICROPOSIT S1800 PHOTO RESIST DYED SERIES**

**Figure 2. Spin Speed Curves**




**MICROPOSIT® S1813® PHOTO RESIST**

**Figure 3. Dispersion Curve**



## Exposure

Proper film thickness selection is critical in order to reduce photospeed and critical dimension variability. The interference curves displayed in **Figure 4** illustrate the photospeed variability as a function of film thickness. Dyed versions suppress the interference effects which are more pronounced when exposing with monochromatic light sources and when using reflective substrates.

| Process Parameters (Refer to Figure 4) | |
|---|---|
| Substrate | Silicon |
| Coat | GCA 1006 ²WAFERTRAC® |
| Softbake | 115°C/60 seconds Hotplate |
| Expose | GCA 8500 G-Line (0.35 NA) |
| Developer | MF-321 / 10 + 30 DSP @ 21°C |

MICROPOSIT S1800 SERIES PHOTO RESISTS can be exposed with light sources in the spectral output range of 350 nm - 450 nm. The exposure properties have been optimized for use at 436 nm. **Figures 5 and 6** show the absorbance spectrums for MICROPOSIT S1813 and S1813 J2® PHOTO RESISTS.

| Process Parameters (Refer to Figures 5 and 6) | |
|---|---|
| Substrate | Quartz |
| Coat | 12,300Å |
| Softbake | 115°C/60 seconds Hotplate |
| Expose | Oriel Scanning Wedge |
| Measure | Hewlett Packard 8450A Spectrophotometer |

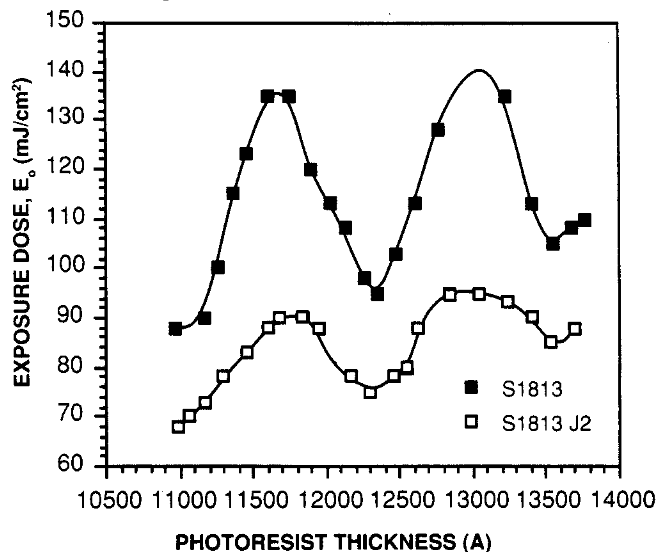
**Table 1** summarizes the Dill parameters for each MICROPOSIT S1800 SERIES PHOTO RESIST version. Dill parameters are used in optical exposure models such as SAMPLE and PROLITH.

**MICROPOSIT S1800 SERIES PHOTO RESISTS**
**Table 1. Dill Parameters**

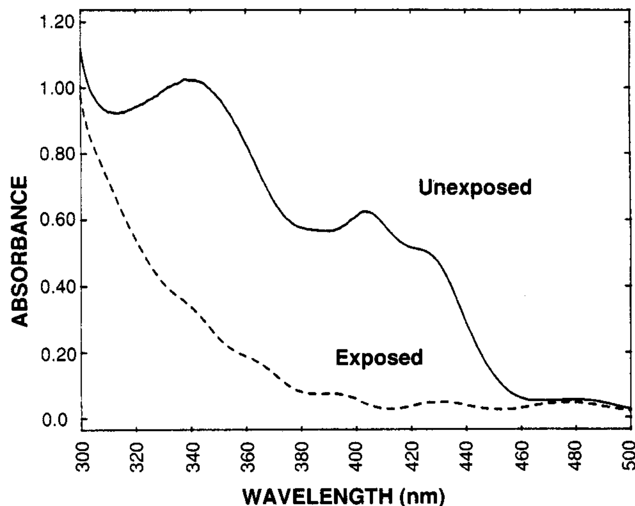
| | 365 nm | | 436 nm | |
|---|---|---|---|---|
| Photoresist | A ($\mu m^{-1}$) | B ($\mu m^{-1}$) | A ($\mu m^{-1}$) | B ($\mu m^{-1}$) |
| S1813 | 1.07 | 0.31 | 0.61 | 0.08 |
| S1813 D1 | 1.05 | 0.34 | 0.58 | 0.26 |
| S1811 J2 | 1.07 | 0.49 | 0.59 | 0.61 |
| S1818 J1 | 1.06 | 0.42 | 0.57 | 0.37 |

Registered trademark of GCA, a unit of General Signal

**MICROPOSIT S1813 and S1813 J2 PHOTO RESISTS**
**Figure 4. Interference Curves**




**MICROPOSIT S1813 PHOTO RESIST**
**Figure 5. Absorbance Spectrum**




**MICROPOSIT S1813 J2 PHOTO RESIST**
**Figure 6. Absorbance Spectrum**

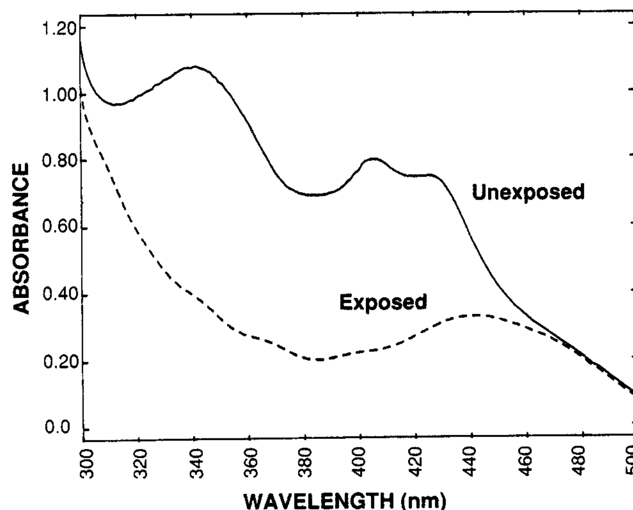
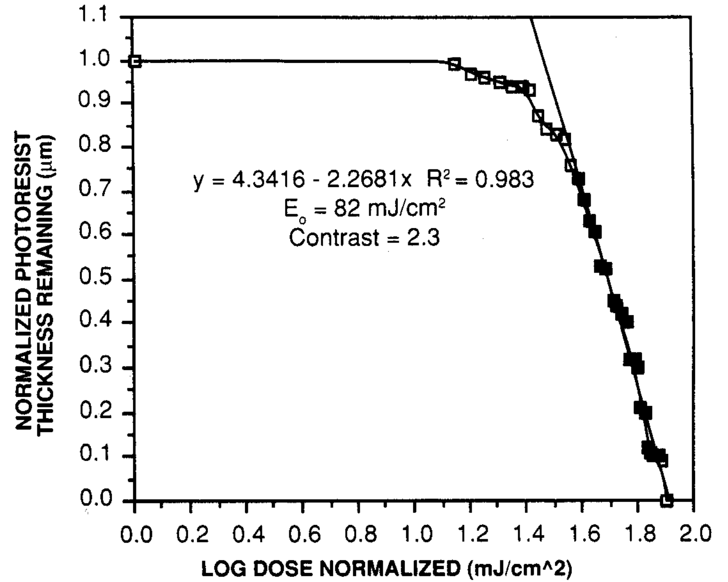


**Figure 7** displays a contrast curve for MICROPOSIT S1813 PHOTO RESIST developed with MICROPOSIT® MF®-321 DEVELOPER. In general, high contrast values correlate to higher angle wall profiles.

| Process Parameters (Refer to Figure 7) | |
|---|---|
| Substrate | Silicon |
| Coat | 12,300Å |
| Softbake | 115°C/60 seconds Hotplate |
| Expose | GCA 8500 G-Line (0.35 NA) |
| Develop | MF-321 / 10 + 30 DSP @ 21°C |

**MICROPOSIT S1813 PHOTO RESIST**
**Figure 7. Contrast Curve**

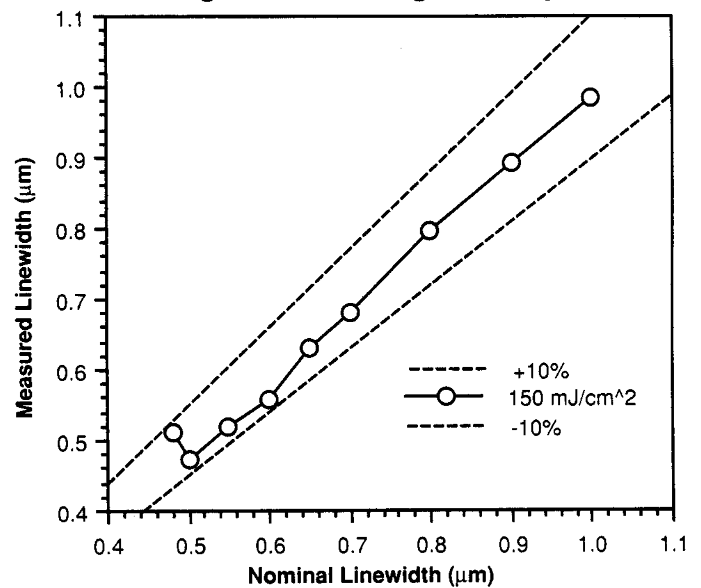



## DEVELOP

MICROPOSIT S1800 SERIES PHOTO RESISTS are compatible with both Metal-Ion-Free (MIF) and Metal-Ion-Bearing (MIB) developers. A photoresist and developer system is dependent upon specific application requirements. Contact your local Shipley Technical Sales Representative for additional product information.

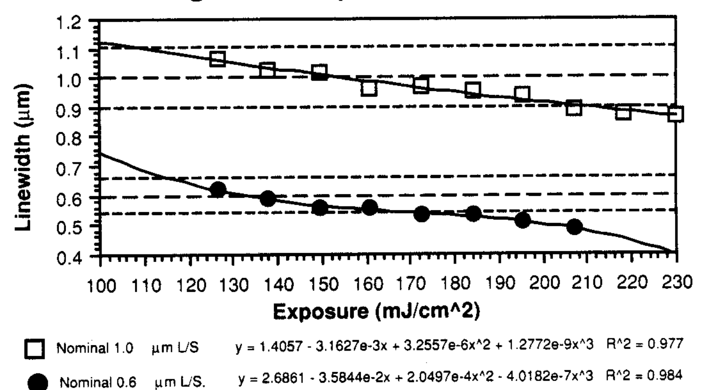
**Figures 8 thru 10** illustrate the lithographic functionality of MICROPOSIT S1813 PHOTO RESIST using process parameters designed to maximize resolution while maintaining excellent exposure and focus latitude (refer to SEM photographs in **Figure 1**). The functional lithographic responses are summarized in **Table 2.**

**MICROPOSIT S1813 PHOTO RESIST**
**Figure 8. Masking Linearity Plot**




| Process Parameters (Refer to Figures 8 thru 10) | |
|---|---|
| Substrate | Silicon |
| Coat | 12,300Å |
| Softbake | 115°C/60 seconds Hotplate |
| Expose | Nikon 1505 G6E G-Line (0.54 NA) |
| Develop | MF-321 / 15 + 50 DSP @ 21°C |

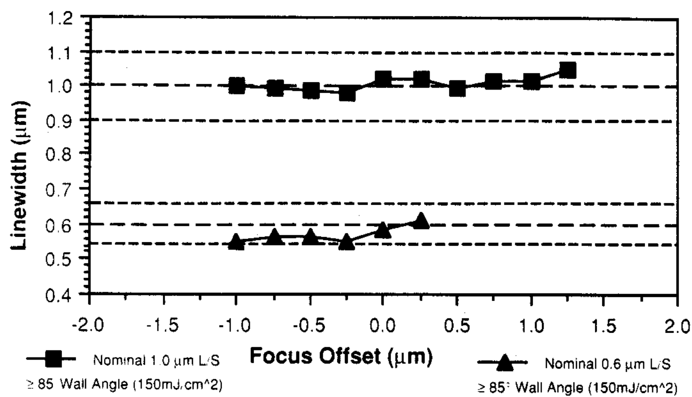
**MICROPOSIT S1813 PHOTO RESIST**
**Figure 9. Exposure Latitude Plot**




**MICROPOSIT S1813 PHOTO RESIST**
**with MICROPOSIT MF-321 DEVELOPER**
**Table 2. Functional Lithographic Summary Data**

| Sizing Energy | 150 mJ/cm² (1.3 $E_0$) | |
|---|---|---|
| Resolution | 0.48 µm | |
| Masking Linearity (±10% CD) | 0.50 µm | |
| | 1.0 µm L/S | 0.60 µm L/S |
| Exposure Latitude (±10% CD) | 65% | 45% |
| Focus Latitude (±10% CD) ≥ 85° Wall Angle | 2.25 µm | 1.25 µm |

MICROPOSIT S1813 PHOTO RESIST
Figure 10. Focus Latitude Plot




## Handling Precautions

WARNING: MICROPOSIT S1800 SERIES PHOTO RESISTS are combustible mixtures containing propylene glycol monomethyl ether acetate. Contact with eyes, skin and mucous membranes causes irritation. Handle with care. Do not get in eyes, on skin or on clothing. Avoid breathing vapors or mists. Use with adequate ventilation. Wash thoroughly after handling.

Wear chemical goggles, chemical gloves and suitable protective clothing when handling MICROPOSIT S1800 SERIES PHOTO RESISTS.

In case of eye or skin contact, flush affected areas with plenty of water for at least 15 minutes. Then contact a physician at once.

Consult product Material Safety Data Sheet before using.

## Toxicological and Health Advantages

The solvent used in MICROPOSIT S1800 SERIES PHOTO RESISTS is propylene glycol monomethyl ether acetate. Toxicological studies reported that propylene glycol derivatives contained in MICROPOSIT S1800 SERIES PHOTO RESISTS do **not** demonstrate the adverse blood effects and reproductive effects that ethylene glycol derived ether acetates demonstrate (NIOSH Current Intelligence Bulletin 9 - 5/2/83).

## Storage

Store MICROPOSIT S1800 PHOTO RESISTS only in upright, original containers in a dry area at 50°-70°F (10°-21°C). Store away from light, oxidants, heat, and sources of ignition. Do not store in sunlight. Keep container sealed when not in use.

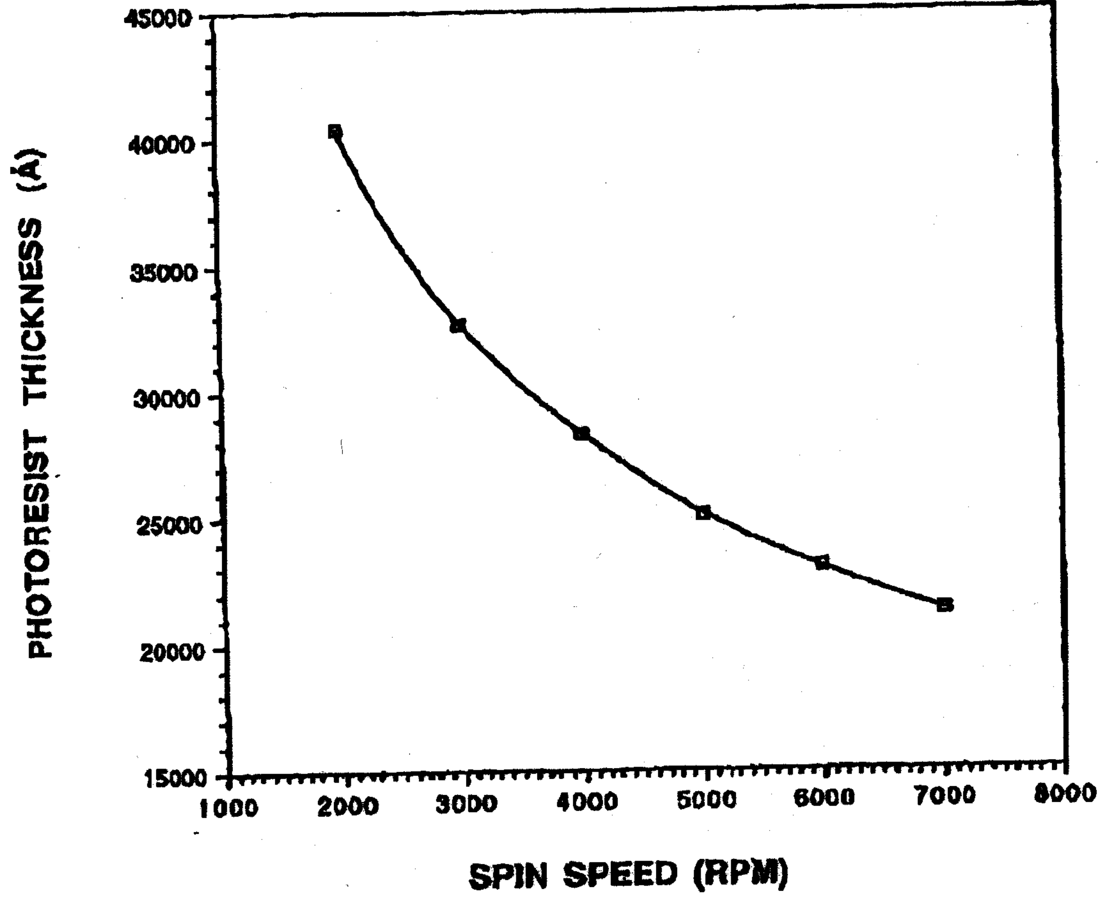
## Equipment

MICROPOSIT S1800 SERIES PHOTO RESISTS are compatible with most commercially available photoresist processing equipment. Compatible materials include stainless steel, glass, ceramic, unfilled polypropylene, high density polyethylene, polytetrafluoroethylene, or equivalent materials.

## Technical Literature

Please contact your Shipley Technical Sales Representative for information on the use and performance of Shipley products.

# MEGAPOSIT SC1827 PHOTO RESIST
## SPIN SPEED CURVE




**PROCESS PARAMETERS:**

SUB: 100 mm. Silicon
PRIME: 1.6 min. HMDS (amb.)
SB: 105°C/60 secs.
TRACK: SVG 81
MET: NANOMETRICS 210
LOT: [illegible]