

Hydrazine Gas Delivery for Thin Film Processing

Low temperature, high reactivity nitride source for ALD processes

RASIRC **BRUTE** Hydrazine delivers water-free hydrazine (N_2H_4) gas into atomic layer deposition (ALD) processes in a repeatable method. BRUTE Hydrazine includes a vaporizer pre-loaded with hydrazine and a proprietary solvent.

BRUTE Hydrazine can be used for a variety of metal nitride deposition processes at temperatures below 400°C:

- Precursor for Ti_3N_4 gate stack and other transistor applications
- Sidewall spacer/etch stop (Si_3N_4) between metals and silicon or dielectric materials
- Double patterning involving SiO_2 and Si_3N_4
- SiGe passivation layer
- Metal nitride deposition (TaN WN)

RASIRC BRUTE Hydrazine Benefits

- Higher reactivity than NH_3 enables lower temperature ALD applications (200-400°C)
- Penetrates high aspect ratio structures to achieve uniform films
- Lower temperature allows for gate-first processing

- Replacement for N_2 plasmas for uniform Si_3N_4 barrier films and step etching
- Proprietary delivery process, ensuring higher purity

Background

Plasma and ammonia have been used for growing nitride films in the past. These methods do not work with next generation materials that require lower thermal budgets and feature high aspect ratio structures. Plasma cannot uniformly coat the side walls of high aspect ratio structures and can cause surface damage. Ammonia has limited reactivity at low process temperatures constraints imposed for the new materials.

Hydrazine has been proposed as a nitride source but residual water in commercially available hydrazine leads to imperfect films containing oxygen. BRUTE Hydrazine solves that problem by delivering the hydrazine with minimal water. Anhydrous hydrazine can effectively create high quality nitride thin films.

How it Works

BRUTE Hydrazine provides a stable, reliable flow of anhydrous hydrazine gas from a



liquid source in a sealed vaporizer. The liquid source combines anhydrous hydrazine and a proprietary solvent that acts as a stabilizer.

The BRUTE Hydrazine vaporizer converts source liquid hydrazine to gas while leaving behind the non-volatile solvent. Hydrazine vaporizes into the head space of the vaporizer. The resulting hydrazine gas is swept to process via the pressure gradient or by an optional carrier gas that flows through the head space (or ampoule).

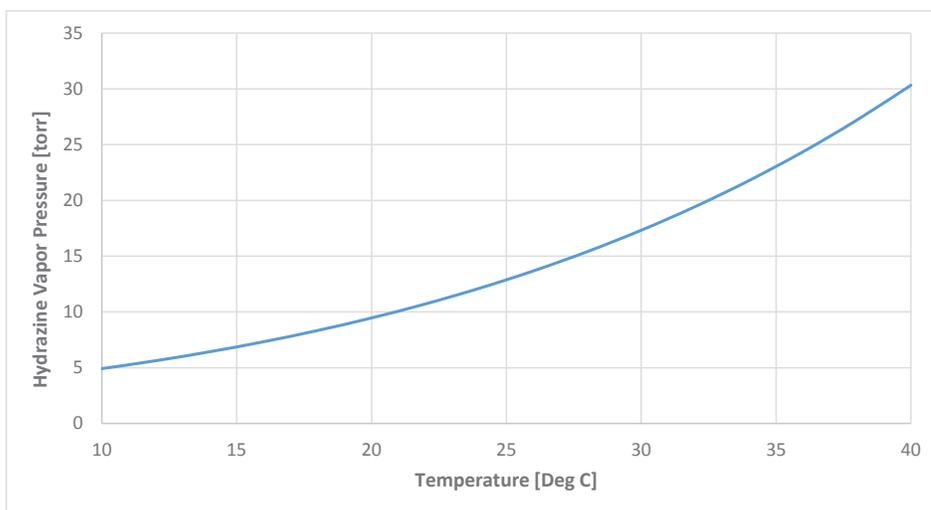


Figure 1: Theoretical Vapor Pressure Curve of BRUTE Hydrazine.



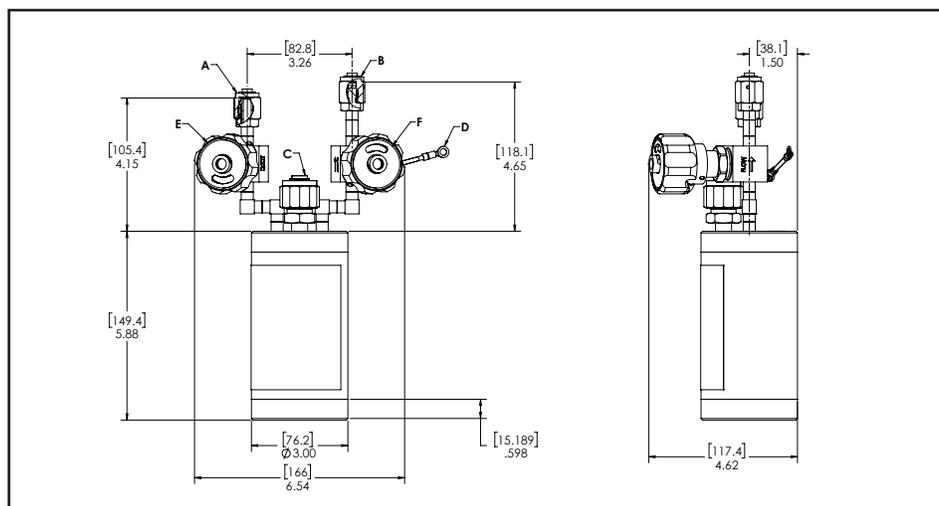


Figure 2: BRUTE Hydrazine (250g), Standard Lid. Based on RASIRC Drawing #203403

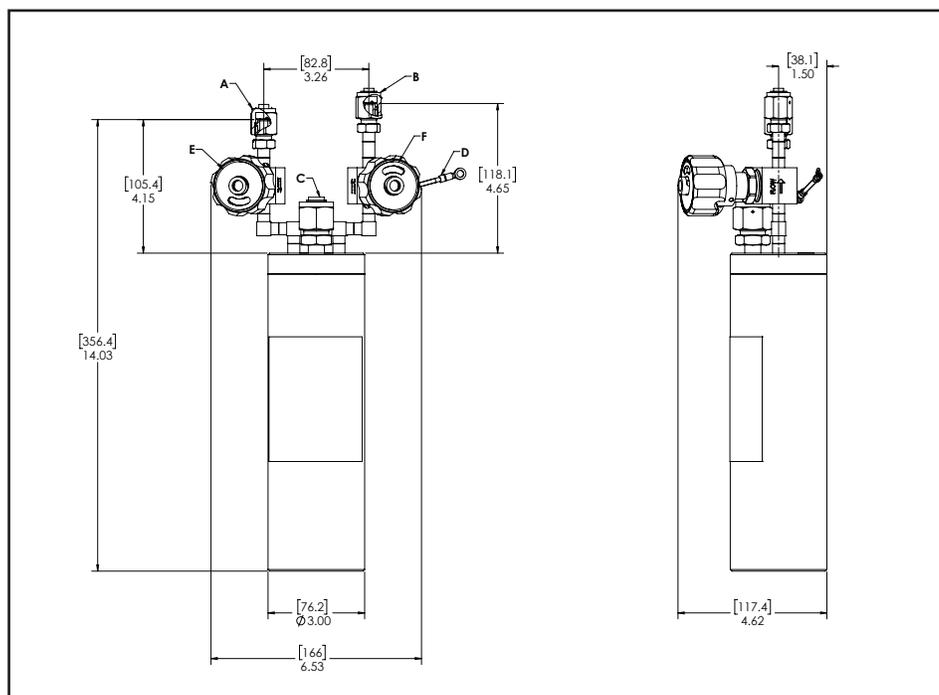


Figure 3: BRUTE Hydrazine (750g), Standard Lid. Based on RASIRC Drawing #203416

Table 1: Vaporizer Components

| | Description | Size/Type |
|---|------------------------|---|
| A | Inert Gas Outlet | 1/4" Male VCR |
| B | Process Gas Outlet | 1/4" Male VCR |
| C | Fill Port - DO NOT USE | 1/2" Male VCR |
| D | Grounding Cable | 18" cable with M5 terminal ring (included) - RASIRC P/N: 201990 |
| E | Inlet Valve | Manual Lock Out/Tag Out Valve |
| F | Outlet Valve | Manual Lock Out/Tag Out Valve |

Table 2: Specifications

| | |
|---------------------------|--|
| Operating Conditions | <ul style="list-style-type: none"> • Temperature: 10-40°C • Max Pressure: 1500 torr |
| Carrier Gas | <ul style="list-style-type: none"> • 0-500 sccm (user supplied MFC) • Filtered to 0.003 µm • Purified to < 1ppb contaminants • Nitrogen or inert gas (NO OXYGEN) |
| Vapor Pressure | <ul style="list-style-type: none"> • 31 torr at 40°C • 13 torr at 25°C See Figure 1 for graph |
| Tools & Supplies Required | <ul style="list-style-type: none"> • PPE (see SDS) • (2) 1/4" SS VCR gaskets no silver plating (Swagelok PN:SS-4-VCR-2-VS) • 3/4" and 5/8" wrenches |
| Required Facilities | <ul style="list-style-type: none"> • Facility approved abatement system for hydrazine • Hydrazine safety gas monitor • Electrical ground connection • Proper ventilation |

How to Order

To place an order for **BRUTE Hydrazine** refer to Table 3 below. Choose the mass of solution desired and contact RASIRC at sales@rasirc.com to order the associated part numbers.

Table 3: BRUTE Hydrazine Vessel Rental

| Name | Mass of Solution | Chemistry Part Number | Lid Type | Vessel Part Number |
|------------------------|------------------|-----------------------|----------|--------------------|
| BRUTE Hydrazine Vessel | 250g | 100723 | Standard | 100834 |
| | 750g | 100715 | Standard | 100835 |

About RASIRC

RASIRC specializes in products that generate and deliver gas to fabrication processes. Each unit is a dynamic gas plant in a box—converting common liquid chemistries into safe and reliable gas flow for most processes. First to generate ultra-high purity (UHP) steam from de-ionized water, RASIRC technology can now also deliver hydrogen peroxide gas and hydrazine gas in controlled, repeatable concentrations. RASIRC gas delivery systems, humidifiers, and closed loop humidification systems are critical for many applications in semiconductor, photovoltaic, pharmaceutical, medical, biological, fuel cell, and power industries.

