

# NANO CHEM<sup>®</sup>

## PURELITE™ Purification Medium-Non DG NANO CHEM<sup>®</sup> Inert and Hydrogen Gas Purifiers

Removal of Hydrocarbons, CO<sub>2</sub> and H<sub>2</sub>O

### Overview

NANO CHEM<sup>®</sup> PURELITE™ Purifiers are designed to remove trace hydrocarbons, CO<sub>2</sub> and H<sub>2</sub>O from inert gases and hydrogen. An example of a process sensitive to hydrocarbon contamination is DUV lithography. Deposition of carbon-based films from purge gas contaminants on the optical components decreases light throughput and negatively affects the patterning process.

NANO CHEM<sup>®</sup> PURELITE™ purification medium, the active component in White Knight™ (WK-Series) Purifiers, removes non-methane hydrocarbons and H<sub>2</sub>O with sub-ppb efficiency and high capacity for extended purifier lifetime. CO<sub>2</sub> is removed to LDL limits of instrumentation.

### Applications

- Purge gas purification for photolithography where trace hydrocarbons are detrimental to transmission of optical components (carbon deposits)
- Compatible gases include Nitrogen (N<sub>2</sub>), Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe), Hydrogen (H<sub>2</sub>), Deuterium (D<sub>2</sub>), and Sulfur Hexafluoride (SF<sub>6</sub>)

### Features and Benefits

- Custom-designed adsorbent material for point-of-use removal offering:
  - **High Capacity**
  - **Long Lifetimes**
  - **Sub-ppb Efficiency**
  - **Low Overall Cost of Ownership**
- Room temperature operation - no power required
- No conditioning required
- Easy to install and operate
- Media refills available for WK-500F and WK-2500F purifier models
- Patented technology
- Non dangerous good

### Specifications

- 0.003 µm particle filter with 9-log retention (99.9999999%)
- Internal surface finish < 10 µin R<sub>a</sub>
- Metal parts of Stainless Steel, Type 316L
- Maximum operating temperature of 40°C (104°F)

### n-Butane Removal by NANO CHEM<sup>®</sup> PURELITE™ Purifier Capacity

Large capacity of PURELITE™ Purifier for n-butane removal was experimentally verified by FTIR (Figure 1). Heating to 100°C and extended purging with inert gas did not release adsorbed n-butane, indicating strong affinity for hydrocarbons.

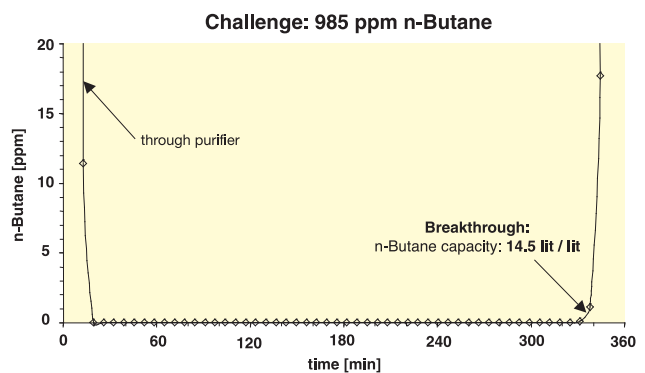


Figure 1: n-Butane Capacity of PURELITE™ Purifier 30 ml bed volume, 958 ppm challenge at 1.4 slpm (0.8 NM<sup>3</sup>/hr)

FTIR (Fourier Transform Infrared Spectroscopy)

### Efficiency

APIMS measurements indicate removal of n-butane in argon to < 100 ppt (Detection Limit of APIMS) at challenges as high as 50 ppm (Figure 2). Purifier was initially bypassed for < 25 minutes to verify instrument response.

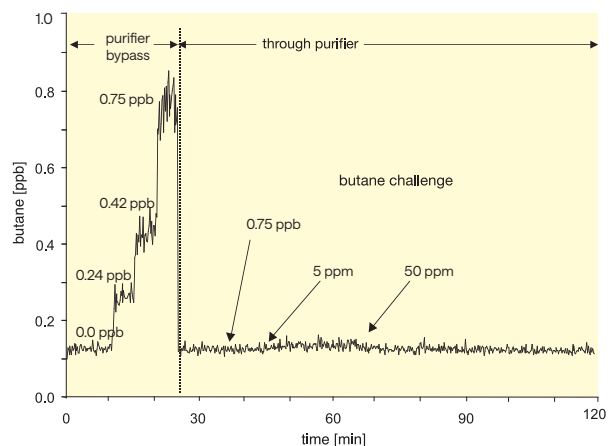


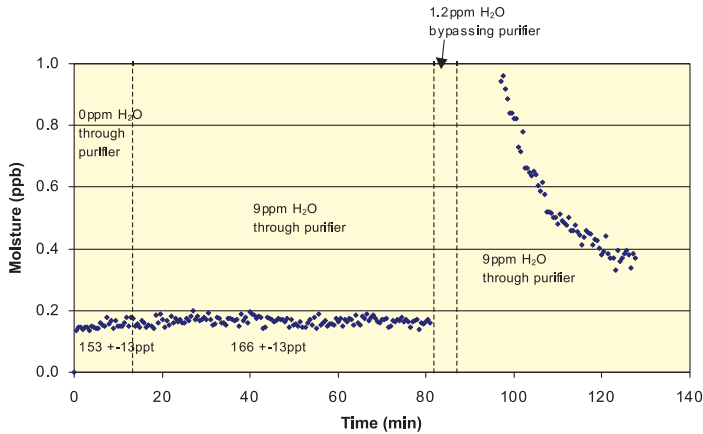
Figure 2: Efficiency of PURELITE™ Purifier for n-butane in argon removal at challenges from 0.75 ppb to 50 ppm. (200 ml bed volume)

ppt – parts per trillion

APIMS (Atmospheric Pressure Ionization Mass Spectrometry)

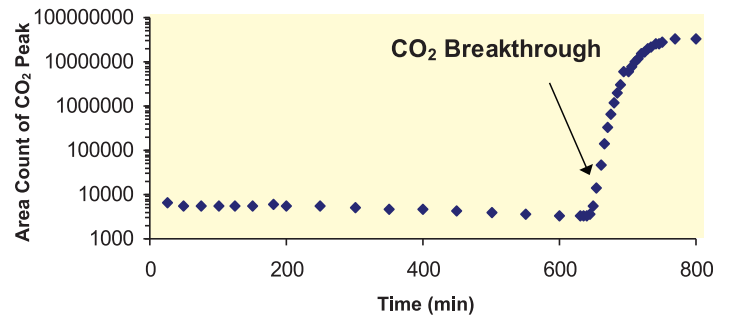
## APIMS Efficiency Data

9 ppm H<sub>2</sub>O Challenge in Argon demonstrated moisture efficiency of less than 300 ppt, (detection limit of the APIMS)



## CO<sub>2</sub> Capacity in Helium

Capacity of 5.5 L/L based on a challenge of 500 ppm CO<sub>2</sub> in He at 1 slpm



## Analytical Performance

### Typical Performance

Impurities are typically removed to the detection limits of state-of-the-art analytical techniques

Impurity/ Matrix	Efficiency (ppb)	Challenge (ppm)	Analytical Method
H <sub>2</sub> O in Ar	< 0.3 (LDL)	35	API-MS
CO <sub>2</sub> in He	< 11 (LDL)	500	GC-DID
GeH <sub>4</sub> in N <sub>2</sub>	< 0.1 (LDL)	2.5	API-MS
SiH <sub>4</sub> in N <sub>2</sub>	< 0.1 (LDL)	2.5	API-MS
Siloxanes in N <sub>2</sub>	< 0.1 (LDL)	(trace)	API-MS
C <sub>4</sub> H <sub>10</sub> in Ar	< 0.2 (LDL)	50	API-MS

LDL Lower Detection Limit of Analytical Test Method

APIMS Atmospheric Pressure Ionization Mass Spectrometry

GC-DID Gas Chromatography with Discharge Ionization Detector

## Purifier Models / Sizes

NANOCHEM® PURELITE™ purification medium is available in a wide variety of hardware configurations for point-of-use, distribution, source and bulk purification applications:

Model	Maximum Recommended Flow Rate**		Media Volume ml or liters	Maximum Allowable Operating Pressure	
	slpm	(NM <sup>3</sup> /hr)		psig	(MPa)
Purifilter®	3	(0.2)	25 ml	1,000	(7)
A-Series*	50	(3)	300, 500, 2000 ml	500	(3.55)
L-Series	8-150	(0.5-9)	60, 300, 500, 2000 ml	500	(3.55)
H-Series	50	(3)	300, 500 ml	500	(3.55)
HP-Series	50	(3)	500 ml	2,850	(19.8)
MS-Series	1000	(60)	8, 16, 32 liters	300	(2.17)
WK-Series*	3-250 1000	(0.2-15) (60)	55, 500, 2500 ml 9 liters	500 350	(3.55) (2.51)

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