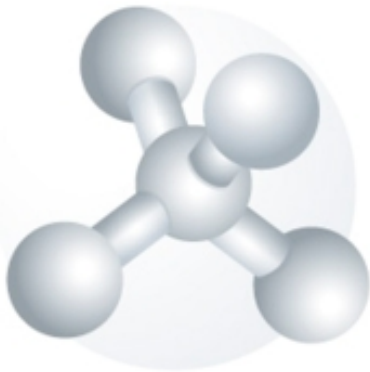


# ALOHA™ Special Precursors



## ToRuS

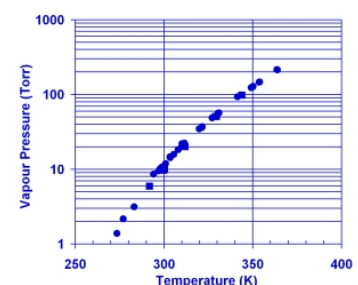
RuO<sub>4</sub> based new Ru source

Air Liquide Ru Precursor for C-free, high adhesion Ru / RuO<sub>2</sub> ALD, RuO<sub>2</sub> CVD and other applications.

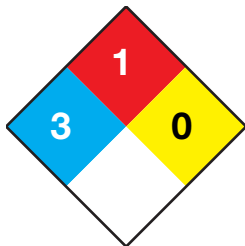
- Ruthenium is used as an electrode material over high-k dielectric capacitors in MIM structure. It is also envisaged as a metal gate material in 45 nm and below devices, and is envisaged in BEOL as a direct adhesion and seed layer for electroplating.
- ToRuS blend has been developed targeting a highly safe product: it is non-flammable, non-corrosive, and non harmful in case of leak (very low LC50). Handling and delivery is also facilitated.
- ToRuS shows good adherence on many substrates: Si, SiO<sub>2</sub>, SiN, SiC, Al<sub>2</sub>O<sub>3</sub>, Ta<sub>2</sub>O<sub>5</sub>, HfO<sub>2</sub>, La<sub>2</sub>O<sub>3</sub>, TaN.
- Chemical vapor deposition evaluation has shown that ToRuS exhibits no incubation time for better thickness control.
- In addition, ToRuS has the excellent volatility among Ru precursors, allowing high deposition rate without canister or line heating.
- Like for most of the ALOHA advanced products, each canister of ToRuS is supplied with a BALAZS CofA and meets stringent purity requirements. Please consult [www.balazs.com](http://www.balazs.com) for more information on Air Liquide's BALAZS analytical services.

### Physical Chemical Properties

Properties	
Physical State	Liquid
Colour	Yellow
Melting Point	-135°C
Boiling Point	61-76°C
Vapour Pressure	10 Torr @ 25°C
Viscosity	0.6 cP @ 23 °C
Liquid Density	1.4-1.6 g.cm <sup>-3</sup>



## Hazard Rating



### HMIS

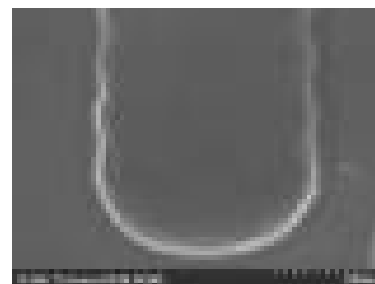
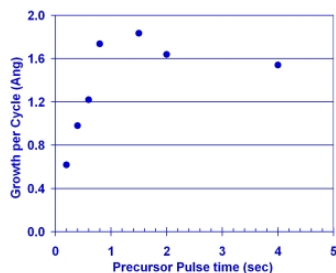
Health: 2  
Flammability: 1  
Reactivity: 0

- Please consult ALOHA for detailed material compatibility recommendation.

## ToRuS ALD Performances

Left: ToRuS ALD Pulse time influence

- Ideally ToRuS can achieve high growth rate by ALD.
- Ru films are obtained from 150°C.
- Incubation time is negligible on the Si and SiO<sub>2</sub> substrates.



Right: Obtained Ru film by ToRuS ALD

## Packaging & Dispensing System

- ToRuS can be packaged in a variety of canisters depending on the application.
- For on-board applications, ToRuS is usually supplied in canisters with various valving and dip-tube configurations. Multipoint or continuous level sensing systems can also be customized to meet each specific requirements.
- ALOHA's on-board canisters have all-metal construction and are cleaned and dried by state of the art techniques. ToRuS can also be filled in properly documented customer-supplied canisters.
- Smaller R&D level packages are available as well for basic research needs.



## Transport Information

- Proper shipping name: Not regulated
- UN Number: Not Applicable
- Packing group: Not Applicable
- The components of this product are listed on the TSCA Inventory.



Air Liquide ALOHA is providing a complete advanced precursor solution. ALOHA portfolio covers low k, high k, barrier, metal gate, electrode, including some proprietary solutions for SiN, metals and High k. Certain aspects of Air Liquide technology may be covered by Air Liquide Intellectual Property rights.

For more information please contact: [aloha@airliquide.com](mailto:aloha@airliquide.com) or your local Air Liquide representative.

