



ICECUBE

# High Energy Reactions Made Safe and Easy



## PRODUCT OVERVIEW

High energy reactions are an extremely important part of synthetic chemistry, but are often underutilized due to their hazardous nature or complexity of set up. The IceCube reactor was designed to overcome these issues by providing an easy-to-use and safe instrument. Specifically it was developed for performing reactions such as lithiation, diazotization, azide formation, nitration, and ozonolysis at low temperatures for enhanced safety.

## HOW DOES IT WORK?

IceCube utilizes Peltier plates technology to cool down to  $-70^{\circ}\text{C}$  or  $-50^{\circ}\text{C}$  using only tap water and electricity. The reaction channel is composed of a Teflon tube with variable length embodied in a metallic plate that is fixed on the Peltier plate. The reagents are delivered into the temperature-controlled reaction zones continuously and product is easily collected in a vial, flask or vessel.

## FEATURES

### Powerful reaction heat dissipation system for safety

Thanks to the great contact surface/volume that flow chemistry provides, there is a highly-efficient heat exchange between reaction channel and the metallic plates, which means a very accurate control of the temperature.

### Two reaction zones for multi-step synthesis capabilities

IceCube has 2 reaction zones with controlled temperature. On each of them can be placed a metallic plate in which the Teflon reaction channel has been placed in the desired configuration. IceCube allows multiple set-ups, with one or more independent substance inlets and outlets, making it highly versatile and customizable.

### Low temperature and heating capability for versatility

The 2 reaction zones of the IceCube can be operated at different temperatures. The “main reaction zone” can be cooled down to  $-70^{\circ}\text{C}$  or  $-50^{\circ}\text{C}$  and heated up to  $80^{\circ}\text{C}$ . The “quenching zone” can work between  $-30^{\circ}\text{C}$  and  $80^{\circ}\text{C}$ .

### Ozonolysis, lithiation, azidation and nitration on one system

Thanks to the low and well controlled temperatures that can be achieved in the IceCube, those reactions that are considered complicated and dangerous can be carried out in an easy and safe way.

### Easy to use, set-up and operation. Plug and play

After the configuration of the reaction has been planned, simply coil the Teflon tubes in the metal plates, place the metal plates on the reaction zones, connect the inlet and outlet lines, set up the reaction parameters and once the system is ready, start the flow!

The IceCube is a revolutionary continuous flow low temperature reactor specifically for high energy reactions to be performed in a highly controlled and safe manner. The System is composed by 4 modules: Ozone Module, Pump Module, Reactor Module and Control Module. This makes the system highly customizable, modules can be configured or purchased separately to match the configuration that suits your work the best.



**PUMP MODULE** consists of 2 rotary piston pumps, which have good chemical compatibility. The pumps are connected to two 3-way valves, which control the path of reactant or solvent through the reactor. Single or multiple pump modules can be purchased depending on the need of the chemist.

**Flow rate:** 0.2–4 mL/min (if software controlled)  
**Maximum pressure:** 6 bar

### CONTROL MODULE

All the above parts are software controlled as a whole system via a touch screen interface included into the Control Unit. This device also allows to have a schematic view the whole system and how its parameters change during the time.

**OZONE MODULE** gives you a safe and efficient way of generating ozone from oxygen. The ozone/oxygen amount is precisely controlled through the built-in mass flow controller. The system can also be used as a powerful and compact standalone ozonizer.

**Oxygen flow rate:** 10–100 mL/min  
**O<sub>3</sub>/O<sub>2</sub> w%:** up to 14% (at 20 mL/min oxygen flow rate)  
**Maximum outlet pressure:** 2.1 bar

**REACTOR MODULE** is a very versatile reactor capable of controlling even extremely exothermic reactions safely and simply. Composed of two reactor plates with Peltier heating/cooling, and a reaction line made of Teflon for wide chemical compatibility, the

system may be configured for 2, 3 or 4 reactants in one sequence. Difficult or dangerous reactions such as lithiation, azide generation or ozonolysis may now be performed and quenched immediately eliminating the risk associated to dangerous intermediates.

**Main reactor block temperature:** -70 or -50–+80°C  
**Maximum main reactor volume:** 8 mL  
**Tubing:** 1/16" OD 1 mm or 1/8" OD 2 mm ID PTFE  
**Quench reactor plate temperature:** -30°C–+80°C  
**Quench reactor volume:** max. 4 mL  
**Number of mixers:** customizable (T mixers, static mixers)  
**Pressure capability:** max. 10 bar

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